Managing Information Technology Change in the Decade of the 80's

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TO: Federal Information Technology Managers

As early as 1966, the importance of information technology planning was recognized and stated in Public Law 89-306. With the passage of the Paperwork Reduction Act of 1980, a renewed commitment must be made to improving our information technology plans and planning process. The need to perform such planning is even more critical in the information technology field which has been and will continue to be faced with rapid technological innovation. Your challenge as Federal Managers is to identify, plan for, and operationally implement oncoming technology on a cost effective basis. Your ability to perform this role will be a key contributing factor towards increasing productivity in the public sector.

Your attendance at the conference on "Managing Information Technology Change in the Decade of the 80's" should provide you with crucial insights into the process of managing change and strategic level information technology planning. I support the objectives of the conference and look forward to seeing the results in future DoD and other government information systems.

Sincerely,

JACK BROOKS
Chairman

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Opening Remarks DoD Long Range ADP Planning Conference

Honorable Jack R. Borsting, Ph.D.
Assistant Secretary of Defense
(Comptroller)

Ladies and Gentlemen, I take great pleasure in welcoming you to the first major Department of Defense Long Range ADP Planning Conference.

Each of you has major responsibilities in information technology, most of you directly within the Department of Defense. This conference is focused on you and those responsibilities. Over the next two days you will hear an impressive group of speakers and panels discuss the technological, policy and managerial trends that will come to bear on all of us during the 1980's. We initiated this conference because we believe these trends have tremendous implications for the way we manage and utilize information technology within the Department. Let's just touch on a few of the more obvious trends.

- The word processing, personal computer and general office automation markets are exploding, blurring the traditional application and organization boundaries of automation.
- Satellite, fiber optics and local communications cable technologies provide enormous potential for flexible and inexpensive communications between different configurations of automated systems.
- While this new technology comes upon us we must remember the relatively limited human resources we have in the Department who must design, develop and operate these capabilities. We need to ensure that we retain them and provide them with career progression opportunities.
- The Paperwork Reduction Act, P.L. 96-511, has been enacted and requires aggressive implementation if departments and agencies are to meet the strict timetables for achieving the goals of the Act. The Act, of course, will force all of us to move toward managing all aspects of information collection, processing, storage and distribution as an integrated process.
- Continuing attention to improving the development of large scale systems will be evident. Over the past two years my office has been working with many of you towards full implementation of the automated information systems Life Cycle Management policies. We need to accelerate this process particularly with respect to the adaptation of project manager concepts in the ADP area and in regard to ensuring that the mission requirements for these systems are clearly defined as a prerequisite to heavy capital investments.

Our purpose in providing the range of topics in this conference is not to imply that we believe complex administrative processes are necessary to deal with all of them. Hopefully, just the opposite. If we think hard about these trends - we can plan for them, adjust to them and guide their course. If we do this job well we may minimize policy and oversight burdens for lower cost programs and technologies.

These trends are exciting and challenging for all of us. Of particular importance is the management challenge represented by these developments. Collectively, we have built and installed some basic management policies and practices for information technology - but we will need to continue to improve our policies and practices as we adapt to the enormity of information technology changes in the 1980's. This administration is focusing on productivity of government and if we manage information technology well, we can play a key factor in achieving those productivity goals.

Thank you for participating in the conference and I hope you will find the program as challenging, thought provoking and exciting as I do.

Remarks of
Congressman Jack Brooks

Pertaining To
P.L. 96-511
The Paperwork Reduction Act of 1980

It is a pleasure to have the opportunity to share my views on information management with the people who will be responsible for implementing the Paperwork Reduction Act. After the intense battle that I had with elements within DoD over the passage of the Act, I am sure some of you are surprised at my being here. In fact, I have been told that my participation is being billed as the proverbial "Daniel in the Lion's Den." The only question I have is, "Who is the Lion?"

Whichever is the case, I trust we all share the common effort of promoting the application of sound management concepts to the field of information processing. It is for this reason that I gladly accepted the invitation from Assistant Secretary Borsting to be one of the sponsors of this conference.

I am especially pleased to see that, for once, the government rather than a private company is sponsoring such a conference. Traditionally, of course, these conferences are held by private concerns with the government providing only the bodies, the brains, and the money. I congratulate Assistant Secretary Borsting and his Director of Data Automation, John Carabello, for breaking tradition and taking the initiative. However, if the folks uptown have their way, the next time, I am sure, you will have to do an A-76 analysis.

The decade of the 80's promises to be an era where significant and far-reaching technological change will occur in the government and society as a whole. Electronic funds transfer systems promise to create a revolution in our nation's financial and banking structure. Electronic mail concepts suggest medium- and long-term changes in our postal system and in our whole concept of postal regulation.

Our national survival will depend on information services which provide warning of enemy attack, intelligence about actual and potential enemy activity, and which provide the means of exercising command and control over our nation's forces. Our entire approach to national security will be structured around the existence of powerful information service activities.

As Chairman of the Principal Oversight Committee for the government's acquisition and use of ADP and telecommunications resources I have become increasingly aware of the critical need for improved information systems. The government, after all, is an information intensive activity.

Despite the recent rhetoric about drastically reducing governmental costs, essential programs such as national defense, social security, air traffic safety, and health will continue to be demanded by the public. In times of scarce resources and fiscal control, we must, however, provide government services more efficiently and economically. Proper information resource management supported by modern technology offers the single most important way in which government can maintain and improve services while meeting the mandate of the public to reduce the cost of government.

I consider P.L. 96-511 (the Paperwork Reduction Act of 1980) as the foundation from which you, as Federal managers, will address this challenge in the next decade. The Act, for the first time, integrates the various disciplines of information management and elevates them to the highest levels of government. It also establishes a management framework to: promote a uniform Federal information policy; provide for increased investments in modern technology; and, enhance technical innovation in the operation of government programs.

The elevation of ADP and telecommunications as well as the other information activities to higher management levels is long overdue. The rapid change in technology has altered traditional organizational concepts. P.L. 96-511 provides the necessary statutory basis to combine the separate information activities into one interrelated discipline. We can no longer afford to cater to the bias of any one particular information activity such as ADP or telecommunications—often to the detriment of program performance. With the Paperwork Law, we will now be able to view the total information process and translate that process into support for the entire agency. The senior official called for in the law will now be able to present to the agency head an integrated view of information management and the alternatives available for increasing program efficiency.

Despite these benefits, I expect some government officials will resist the letter and spirit of the law. Some officials view both P.L. 89-306 and the Paperwork Act as unnecessary intrusions into their program prerogatives which offer them few, if any, benefits.

Their attitude reminds me of the story about a hermit who was given a potbelly stove to heat his mountain cabin in the winter. A relative stopped by one winter day and there sat the hermit bundled up with several overcoats, sitting next to an unfired stove. When asked why he had not put any wood in the stove, he replied, "I'll be damned if I am going to feed that thing until it does something for me."

Well, ladies and gentlemen, we have been fighting this attitude for years. It appears that no matter how good the instructions are for using that stove, some agency officials continue to wait for the law to do something for them before they will support it. Ironically, the austere budget which we expect to get under the new administration, with its anticipated program cuts, may get their attention. Hopefully, they will recognize that improvements in management can be used to offset program cutbacks.

Another problem I expect to face is the continued effort by elements within DoD to undermine the implementation of the law. These elements claim that exemption from the Act is necessary to avoid unwarranted disruption of national security activities. It is ironic that they are opposing the one piece of legislation that gives DoD the necessary tools to correct the serious number of managerial and technical problems facing the Department.

Recent studies have shown that DoD's mismanagement of information resources has served to *threaten*, rather than enhance, our national defense. Many DoD information systems are obsolete and outmoded. Its computers cannot communicate with each other. It is losing, at an increasing rate, key technical personnel due to the lack of career paths and performance incentives. The opponents' solution to these problems is to insist on more independence and less oversight. This "solution," of course, will not solve DoD problems. It will tend only to prevent embarrassing disclosure of its failures.

We in the Congress know that our defense establishment is weakened and not nearly as effective as it needs to be. It is of great concern to all Americans. However, to assume that DoD has nothing to do with this state of affairs is inviting serious and far-reaching deception.

We cannot fall prey to the claim that all DoD needs is more money and less oversight. Strong central oversight is urgently needed both within the Department and by OMB to insure that the long-standing problems are recognized and corrective action is taken. Without such oversight, it is certain that no substantial long-term corrections will be made.

Despite my outwardly calm and serene nature, I have over the years gained a reputation of being hardnosed and, sometimes, even difficult. I would like to take this opportunity to once and for all confirm this rumor — when it comes to cutting down waste and inefficiency in government. Notwithstanding, I have a firm and unshakable belief in the benefits of information technology— one that has been unshaken by top-level resistance to change and the numerous failures of ADP-based information systems.

I firmly believe that P.L. 96-511 represents a new era in Federal information management. With your assistance and dedication, the implementation of the law will provide a sound basis to reverse the trends of the 70's and allow us to meet the challenges of the 80's.

To do so you must face the problem squarely and:

- Challenge the very existence of inefficient programs
- Develop clear and concise mission statements
- Design operational systems that take maximum advantage of computer and telecommunication technology and,
- Install performance measures to insure that the system stays with current needs.

P.L. 96-511 provides the basic managerial framework to achieve these goals. It is up to you to make it work.

Managing Information Technology Change in the 1980's

Charles P. Lecht
President
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Corporation

That the improved information systems environment of the 1980s will impact the operation of our government in a very meaningful way is inarguable. The degree to which we are able to effectively manage information systems creation and operation will, to a large measure, determine our future in an increasingly electronic world.

Information systems technology has emerged through the synthesis of a number of heretofore discrete technologies which reached maturation in the 1970's. For the most part, these were previously associated with either computer or communications technologies although some have their origins in such widely disparate fields as library science and anthropology. Thus, processor, database, data collection, storage, message switching, communications, cable and other technologies were brought together in the 1970's in such a way as to allow us to create information processing systems operating within environments of increasing technological symbioses, and increasing complexity. While we are no doubt benefited by the technological syntheses of the 1970's, we are now caused by these factors to encounter concomitant increasingly difficult requirements in planning and managing the 1980's information systems environment. Synthesis of heretofore discrete and disparate technologies requires that the information systems manager re-cast his cost benefit equations to reflect "modern times".

As if symbioses were not enough to handle, rapid change in systems' components continues to occur. For example, advances in large-scale integration (LSI), have occurred so rapidly that the information systems manager is caused to create or operate his applications environment in a state of perpetual fear of unanticipated change resulting in unexpected obsolescence.

That our technology is improving for both implementors and operators of information systems is an unquestionable truth. However, when such improvements take place in an environment characterized by great speed and rapid acceleration of change, we are forced to consider new management methods. Improved forecasting in balance with improved methods of determining where we are as we go about our day-to-day information systems involvements are required. Additionally, improved means must be found to accommodate change with minimum disruption to ongoing information systems processes.

We entered the 1980's in a sea of global change. Among the many changes which we could identify, some are:

- Economic uncertainties
- A seemingly continual shuffling of priorities in private industry and in government
- Obscure policies of both local and global natures
- A lessened U.S. leadership in world technology, and,
- A Department of Defense badly affected by it.

The few seconds I have spent on the enumerated changes above are all I intend to spend on these. My role is to provide my opinion of how one ought to manage in the 1980's, a period anticipated by many to continue to be steeped in change, not the least of which will occur in information technology. Therefore, I have entitled my presentation the same as the title of the conference, namely, "Managing Information Technology in the Decade of the 80's". Presumably someone here thought I might know and therefore be able to advise this erudite group on how to manage during a period of dramatic change in information systems technology. I eschew the notion that anyone, including myself, has the last word on this topic.

Drucker's latest book on "Managing During Turbulent Times" and works by others, provide us with establishing explanations and opinions on how to carry on during change which are really meaningful *but not new*. McLuhan, Hale, and others covered the topic in the 60's. I mention this to put to rest the notion that managing, while steeped in change, is a new thing facing us. It's not a new problem! At the same time one would be remiss in not noting that the waves of techno-economic change, recently facing information technology managers do have their peculiarities! For example:

- The process of computer system selection is burdened by a continual stream of announcements virtually obsoleting the choice before it is

delivered. You have to be a hero to procure a system without criticism. If the life cycle of new systems becomes 3-4 years old and the procurement cycle is 3-4 years, it's a real problem for the agency manager. But, in the phenomena of swiftly changing systems, we have a clue to the future . . . our future. It's no wonder that a recent GAO report on obsolescence of computer systems stated that of 1366 medium-to-large scale systems at the end of fiscal year 1979, only 45 were considered modern.

- The process of setting standards is frustrated by legitimate arguments for abandoning them.
- The staffing situation is acute. An MIS report on January 21, 1981 predicted a shortage of 50K data processing people for 1981.
- Obscure definitions of ROI for mini through maxi computers makes proper funding difficult to obtain.
- Vendor variances in their total offerings are wide but obscure.

The last half of the 1970's was a period of intensified change in all sectors of information systems technology. For the next few minutes I will review some changes with which management has had to contend:

- Computer systems technology returned rapidly increasing price performance improvements — a good and bad thing.
- Our concept of a computer system blurred.
- Depreciation schedules for systems financing collapsed.
- The size of computer systems diminished.
- Industries in which data processing plays a major role underwent change.
- International competition in computer systems technology increased.
- The number of local contestants in the supplier category increased.
- The methods by which we acquired computer systems support were undergoing rapid change.
- Synthesis of computer and communications systems technologies occurred.
- The debate between government and private industry relating to computer and communications technologies increased.

It should be comforting to information systems managers to know that it is not unnatural to suffer from, or be benefited by, change. We must not fall into the trap of believing the change has conspiracy as its primary stimulus. Ineptitude explains it most frequently.

However, my perspective is an optimistic one. That is, notwithstanding the uncomfortable process of coping with change in technology, the changes that are currently taking place are essentially *positive* in nature. The following provide some examples:

- We can get increasing computer power for less cost.
- More people have a computer systems access than ever before.
- Decreases in human productivity can be offset with increases in automation.
- The availability of an increasing sea of technological alternatives provides us with choices.
- Heretofore worthwhile, now obsolete, industrial processes can be replaced through new, more efficient technologies.
- Increasing local and global communications improvements provide us with more efficient applications of our resources.
- Artificial intelligence is around where natural stuff is not available.
- Our recall, memories, logic, perception, mathematical, linguistic powers are increased.
- Our military power is increased.
- Our chances of survival are improved.
- As electronic highways cross the country these provide productivity pathways which embrace our potential; phenomenon not unlike that created by crossing the country with tracks or trains and roads for busses or cars.

The old computer and communications industry is dying. A new, synthesized information systems industry is emerging to support both private and governmental affairs. Companies are changing from those merely supplying the means of processing or carrying information to those collecting and purveying information.

So, now we get back to my theory on why so many announcements in recent days, i.e.:

- Hardware dropping at 20%
- People increasing at 15%
- Software increasing at 30%, and,
- Communications increasing at 12%.

Theory:

- Sell off hardware inventory as soon as possible
- Increase software/people/services, and,
- Sell only part of a system in the future.

Let's look at the death of the computer industry and examine how it happens. To start this scenario, we must

accept the idea that a computer system involves a communications system. Computer business owned communications systems reduce the role of public communications facilities in their operations.

- The computer company of the future will own all or part of communications facilities.

OR

- Enter into a joint venture with a communications company

OR

- Merge with or be acquired by a communications company

OTHERWISE

- It will become a "components" manufacturer.

Communications companies increase their manufacture of hardware/software thus reducing the role played by computer companies in their operations. Communications companies increase their role in providing computer services resulting in:

- Neutralizing the competitiveness of weaker computer companies
- Causing many of these companies to fail, or
- Absorbing them thereby increasing computer technology skills.

As computer companies start to offer communications services they weaken the smaller communications companies, and:

- Neutralize their effectiveness
- Cause them to fail, or
- Absorb them thereby increasing their communications know-how.

The competition for highly skilled computer/communications personnel between computer companies, communications companies and users is intensified.

The war for market shares in the newly emerging computer/communications business is intensified.

The erection of large public and private network facilities created a frenzied plug-in-war by device and component manufacturers. The entire battle brings in new contestants - new and old companies, and old contestants.

The large companies reorganize many times to optimize capabilities to control market shares, profits and profit potential.

The contestants adopt natural and to-be-expected: lock-in strategies for customers and captive vendors, and lock-out strategies for competition.

Law suits in Federal and local courts intensify.

International trade barriers increase.

Long-haul communications competition causes decline in home telephone service forcing it further into private companies.

Critical services in all sectors of government start to break down.

Defense is ultimately affected.

People remember why communications were given the unique status of monopoly in the first place.

Swift re-regulation occurs.

Companies heavily regulated as were the communications companies in the first half of the 20th century but with more severe government controls. Each has:

- High MIP rate generators
- A spectrum of accessible communications
- All the services the mind can imagine
- A sea of devices.

Advice For DoD

The following represents some practical advice for DoD management personnel:

- The NORAD failure episode presents us with a model for understanding the magnitude of the problems with which we must deal in the 80's. That Congress must declare war conflicts with our preparedness in the 1980's.
- Electronic technology accelerates time to the extent that management processes depending upon incremental time delays, collapse.
- Conflicts between private and public sectors relating to dependence upon private industry are yet to be resolved. These include security, privacy, etc. The method of providing data processing support through a mix of discrete DoD facilities and public service bureaus seems untenable yet it is the direction we are going in. Modern systems which are evolving and operating without this mix are impossible.
- A war for personnel to manage in the next 10 years will ignite between suppliers and users in the private sector and users in the public sector. The means must be found to solve this phenomenon until our shortage abates.
- Increased R&D support and self sufficiency of DoD facilities is mandatory. This implies the need for a government computer industry.
- Computer and communications systems products must undergo evaluations not unlike other strategic materials to ensure that DoD is not inadvertently torpedoed by its own plans.
- Methods employed to allocate funds must be modernized to loosen the stranglehold on DoD procurement.

- Efficiency oriented modernization must take place to eliminate redundancy in processing data.
- Standards development must be taken seriously.
- Government regulation of computer and communications suppliers must be re-assessed with a view towards eliminating the paradoxes caused by our monopoly laws.
- Increased action to assess local and foreign alternatives must take place.
- A national policy on information, communications and processors must be created.
- Organizational structures should be re-evaluated to conform to modern times. Management methods heretofore based upon the premise of legislation and obedience must give way to participation and loyalty.
- In lieu of good, long-range planning capability, good in-flight guidance systems concepts must be created. Use the tools with which we are concerned, i.e., computers and communications.
- Increased involvement of private sector expertise.
- Computer systems power planning should involve an ad hoc strategy that includes:
  — Multi-vendor,
  — Runtime configured, and,
  — Systems for both development and operation.
- Attention must be paid to return on investment scenarios which involve rapid depreciation schedules - real and virtual.
- Maintain a high portable/transferable program and data environment.
- Avoid depositing data and programs in an environment from which they may not be easily retrieved.
- Institute rigid contractual agreements.
- Purchase little without clear ROI objectives - lease or rent.
- Study inter-corporate relationships of vendors.

Life Cycle Management

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Introduction

Life Cycle Management (LCM) of electronic computer/communications systems is maturing after thirty years of experimentation and some false starts. This holistic concept provides an improved framework for planning, implementation and managerial control of electronic hardware or software systems.

We adopt the notion that the Life Cycle Management concept has much in common with process control. It is a management tool designed to provide a truly holistic view of some project or identifiable management entity. Thus it deals with all aspects of this managerially captured entity, from its very inception to its final dissolution, encompassing all real and virtual costs that can be associated with the project.

For a more precise definition of terms we may consult the Code of Federal Regulations 41, Public Contracts and Property Management:

> *Systems or Items Life:* A forecast or projection of the period of time which begins with the installation of the systems or items and ends when the need for those systems or items has terminated. Systems or items life is established by the government on the basis of its requirements and is usually set forth in the FFP. Systems or items life is not synonymous with actual life of the equipment.

Further, OMB Circular No. A-109 states that:

> *Life Cycle Cost* means the sum total of the direct, indirect, recurring, nonrecurring, and other related costs incurred, or estimated to be incurred, in the design, development, production, operation, maintenance and support of a major system over its anticipated useful life span.

Finally, DoD Directive 7920.1 lists six major phases for Life Cycle Management. The same Directive also details a number of specific tasks for each of these six phases. While these phases are well publicized and their component tasks are well understood, it is still worthwhile to consider them, albeit briefly, as models for management of hardware, software or systems projects. Each of the six phases meets a very specific management requirement. They have been researched extensively over the years and they have been refined in the course of many successful applications. Thus one would expect that managers everywhere are anxious to adopt these concepts but that does not seem to be the case in many segments of industry or even government. Hopefully, this brief exposition will help dispel some of the persisting doubts about applying LCM concepts, especially to data processing projects.

The User's Viewpoint

LCM is most readily applied to a single project unit at the "local level". By advancing one or more steps in the hierarchical management structure, we can apply it also to a combination of projects under a "global" umbrella. In either case, LCM will be concerned with the definition of deliverables; yet the higher level variables are usually more difficult to assess. Of course, we may proceed hierarchically, from one level to the next, until we reach the top of the organizational structure, but with decreasing hopes of ever achieving system implementation and successful operation.

During three decades of electronic management adventures, many users have experienced traumatic changes in terms of relative hardware and software costs. A recent study by AFIPS (9) indicates that in twenty years the cost-performance of hardware has improved a millionfold. Yet programmer productivity has, at best, only doubled in the same time. It has been intimated that perhaps one reason for this rather startling discrepancy is the fact that programmers can now waste with impunity a million times more machine power — it certainly appears as if they feel compelled to do just that!

It has been estimated (13) that for 1955 systems the hardware component exceeded eighty percent of the system life cycle costs; that by 1965 this fraction had dropped to fifty percent; and that it has been below twenty percent since 1975. Recent technology forecasts indicate that this asymptotic trend will continue; after 1985 software costs will likely exceed ninety percent of the systems life cycle costs!

Thus we can downplay hardware costs in our LCM models. Even the cost of hardware maintenance contributes little, despite its labor intensive aspects. Meanwhile, the cost of designing, developing and testing software is reaching astronomical proportions, despite

methodological improvements, such as software engineering (4) and other sophisticated, widely available software tools (7).

Software specialists assert (13, 14) that the life cycle cost of software products has two major components. The initial investment consists of problem analysis and program design, coding and unit testing, finally system tests and integration; these account for 40, 20 and 40 percent respectively of the total development cost. Much larger are the later costs which accrue from the maintenance of the software product as "bugs" are discovered and corrected, modifications are made to extend its use, or its components are rewritten for new hardware features. It always comes as a shock to management to learn that such operational maintenance costs are four to ten times greater than the initial investment in the software product!

One major cost element incurred by software maintenance results from the deplorable practice of ignoring the need for good documentation. Yet the Federal government, the largest computer user in the world, has addressed this issue in terms of Federal Information Processing Standards, through the National Bureau of Standards. FIPS PUB 38 (6) deals specifically with software life cycle documentation.

Illustrative Example

A typical case study, Table 1, shows pertinent details for an Internal Revenue Service computer with a ten-year economic life. The debit side for this tax administration system adds up to the formidable figure of $1,264.3 millions. The basic hardware cost of $M260.5 represents 20.6 percent of the systems life costs, well within the earlier mentioned range. If we combine the figures for software maintenance ($M121.9) and system development ($M107.0) we observe that the average annual software costs are almost 23 million dollars, not exactly a trivial amount! Finally, the "People Costs" exceed half-a-billion dollars over ten years, reaffirming that electronic data processing (10, 11) has become highly labor intensive.

On the credit side we find that the system will more than earn its keep. Computerized tax audits are expected to bring nearly a hundred million dollars annually into the coffers of the Federal government; processing of intelligence data would provide another twenty million dollars per year. Preparing taxpayers' returns eliminates many erroneous filings with another plus of sixteen million dollars annually on the credit side. Finally, during the months the system is not saturated with its primary function (say, July through December of each calendar year) the IRS expects to pick up another twenty-two million dollars annually by "selling" unused computer resources to other government agencies. The bottom-line for this system life cycle is a respectable annual net gain of $M27.45 which pales only if we learn that in 1979 the IRS actually collected $159,330,829,000 from individual taxpayers!

Planning for Software Productivity

Now that we have established that software is indeed the major component in the life cycle cost of EDP systems we are naturally curious how to manage it more effectively, how to increase the productivity of software shops and what danger signals LCM can perhaps provide.

Frederick P. Brooks (5) observes that planning of a software project is its most important aspect. He recommends budgeting one-third of the total resources to it. One-sixth of the project funds should be allocated for coding and another quarter each to testing of initial program modules

Table 1

COST BENEFIT ANALYSIS: INTERNAL REVENUE SYSTEM

CATEGORY	ADJUSTED COSTS (Millions)	CATEGORY	ADJUSTED BENEFITS (Millions)
Development Cost	$ 107.0	Audit	$ 956.4
Capital Investment	260.5	Intelligence	195.2
Lease and other Costs	84.5	Tax Return Processing	164.8
Equipment Maintenance	137.9	Other	222.4
Software Maintenance	121.9		
Operating Personnel	552.5		
TOTAL COSTS	$1,264.3	TOTAL BENEFITS	$1,538.8

Source: 10 year Economic Life for the Tax Administration System, GAO Report, (LCD-76-114, 23 November 1976).

and of the final system.

David S. Alberts (1) examined the impact of programming errors on the life cycle cost of software. Such errors may occur early in the development phase, or later during the operational phase when software maintenance (i.e., change) is required. He found that about half of the software life cycle costs are attributable to errors which are made with equal probability in these two phases. Our inability to hold down the software error levels, especially in the development phase, is further supported by the work of Marc Bendick (3). He analyzed several software products having from thirty to two hundred thousand lines of coding. He discovered that the average cost of "repairing" an error made during the development phase but not discovered until the software attained operational status was 139 times greater than the cost of writing that one line in the first place!

Thus we come to appreciate the enormous value of the tools collectively referred to as "Software Engineering". Alvin L. Kustanowitz (8) gives an excellent overview of how managers should monitor and control software production costs. He observed that, "All programming projects have one thing in common: A Life Cycle. They begin and sooner or later, they end." But if we insist on simply good, common sense management principles, we can create an environment which is very conducive to improved productivity.

Management Considerations

Life Cycle Management for EDP systems is not a static process, nor a one-shot event. As with many other management tools, it requires periodically revised planning horizons and many unscheduled updates. The initial LCM plan should be conceived when a project is first considered for authorization. At that time certain bounds are established for its scope and hierarchical levels. Specifically, management must then decide how "local" or "global" the LCM plan is to be. This decision is crucial as it determines the fundamental structure of the plan which cannot easily be altered later.

Within this frame of reference the LCM plan must capture all relevant cost data, both direct and indirect. General overhead costs, especially for global type plans, must be apportioned according to some agreed upon formula, authorized and approved by higher level management. This procedural approach will facilitate conflict resolution with other LCM plans within the organizational structure. Of course, it is mandatory that appropriate accounting methods and procedures are put into place to allow identification and costing of all relevant financial data by category and type.

In the EDP environment two major categories are easily identified (2). Hardware costs will involve the host computer, its satellites and terminals. Also included must be hardware maintenance, perhaps through a facilities management contract. Operations at central and remote sites as well as communication costs also fall into this category.

On the software side (12) the LCM plan will surely have to include development, conversion and maintenance of systems and applications programs; also training of systems analysts, programmers, coders and operators; and a projection of user support costs if the machine is accessed by groups and individuals from other departments.

The ground rule is quite simply that during the planning stage every conceivable cost or revenue category should be examined for relevance and possible inclusion into the LCM plan. Some of these data will be estimates and projections. If model planners must resort to "guestimates" they can refine them during later cycles and planning horizons: A poor initial guess is still better than a non-entry into the complicated, hierarchically structured LCM Data Base.

Life Cycle Management can be an invaluable tool if properly supported and implemented. In the struggle for optimal utilization of our limited resources. LCM will pay for itself as it provides the data base for better planning, monitoring and control of computer installations. It may well be the best, all-around firing insurance an EDP manager can obtain . . .

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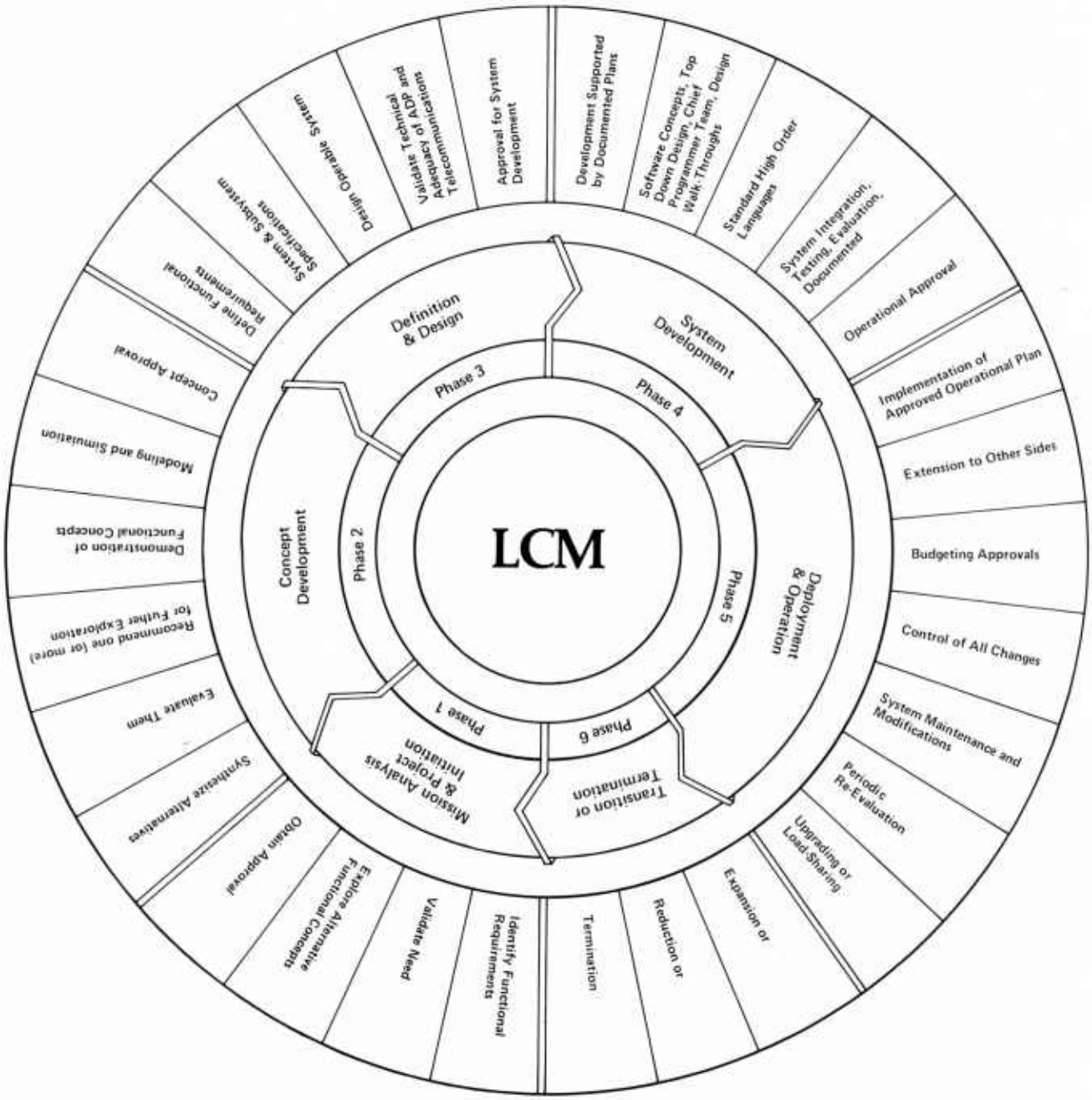
Figure 1

Six Phases and Thirty Tasks Detailed for Project Life Cycle Management



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Improving Productivity of Computer Personnel

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In an era of declining and tightening resources, managers are acutely interested in ways to improve productivity of computer personnel. Hardware costs continue to decrease while labor costs continue to increase. Management is primarily emphasizing technical improvements such as better methods of design and programming. Certainly these activities are important. Equally important, however, are improvements in the motivation environment.

Our nationwide research over the past three years has shown that motivation can be improved significantly — if management concentrates on the right activities. For example, a recent project of ours in a New England firm cut turnover in half. The company has over 1,000 analysts and programmers. Turnover was close to the national average, 25 percent. The 50 percent reduction in turnover produced an important increase in productivity. This is not an unusual case. Management availed itself of the new tools in the human resource area and simultaneously conducted for all supervisors a course on employee motivation. Both of these improvement activities will be discussed next.

Ascertaining Employee Perceptions

The survey instrument is the Job Diagnostic Survey for Data Processing (JDS/DP). My co-researcher, Robert A. Zawacki, and I originally sought to design a survey instrument peculiar to the computer field. After two months of evaluating various instruments we decided to utilize, instead, the Job Diagnostic Survey (JDS) developed by J. Richard Hackman (University of Illinois) and Greg R. Oldham (Yale University), for two principal reasons:

- The instrument is conceptually sound. Its validity and reliability have been substantiated in studies of more than 6,000 subjects on more than 500 different jobs in more than 50 different organizations.
- A major objective is to compare our results with prior studies of personnel in other professions. Our hypothesis on the difference between DP professionals and other personnel could be tested.

We expanded the survey questionnaire to include other elements: employee perceptions on relative importance of problems relating to maintenance, realistic work schedules, access to the computer, access to supervisors, and access to others (e.g., users or personnel in other departments whose work affected their own). Also added to the survey instrument were sections on objective setting and the relative importance of eight categories of compensation. This modified instrument is called the JDS/DP.

Key Motivating Factors

Our studies confirmed what the behavioral scientists had learned about our occupations — that the core job dimensions essential for motivation are: skill variety, task identity, task significance, autonomy, and feedback from the job itself. Salary and fringe benefits rank below 10th place in importance to programmers and analysts. The five core job dimensions are defined below:

Skill Variety: The degree to which a job requires a variety of different activities and involves the use of a number of different skills and talents of the employee.

Task Identity: The degree to which the job requires the completion of a "whole" and identifiable piece of work — that is doing a job from beginning to end with a visible outcome.

Task Significance: The degree to which the job has a substantial impact on the lives or work of other people — whether in the immediate organization or in the external environment.

Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling his or her work and in determining the procedures to be used in carrying it out.

Feedback from the Job Itself: The degree to which carrying out the work activities required by the job results in the employee obtaining information about the effectiveness of his or her performance.

Growth Need Strength

While our national studies showed that the core job dimensions are the same for computer personnel as for other occupations, two other characteristics are quite different. One is growth need and the other social need.

The expectation is that people who have a high need for personal growth and development will respond more positively to a job high in motivating potential than people with low growth need strength. Obviously, not everyone is able to become internally motivated — even when the motivating potential of the job is quite high. Behavioral research has shown that the psychological needs of people determine who can (and who cannot) become internally motivated at work. Some people have strong need for personal accomplishment — for learning and developing beyond where they are now, for being stimulated and challenged, and so on. These people are high in "growth need strength" (GNS).

GNS, therefore, is a measure of a person's need for growth. The GNS for analysts and programmers is *higher than any* of the 500 occupations measured by Hackman and Oldham, 5.91 on the scale of 7.

Social Need Strength

The most surprising result of the survey was the measurement of the variable labeled "social need strength" (SNS). Survey questions related to this variable determine an individual's need to interact with others. The average score on this variable for all other professionals was 5.48 on the scale of 7. For all DP professionals in our survey, the score is 4.20; for five organizations the average was only 2.23. Whereas some professions attract people who have a high propensity for, and reinforcement from, interaction with others — DP does not appear to exhibit this characteristic.

Reflecting on this situation, we were not surprised by the JDS/DP identification of low SNS for programmers. We *were* surprised that analysts had equally low SNS. Their job requires a great deal of interaction to ensure success.

Further reflection, however, made us realize that this situation should not have been surprising. What is the typical career path in the systems department? The path is through programming to analysis. So — employees carry their low SNS with them on up the career ladder. Our surveys showed that DP supervisors and managers also have much lower SNS than their counterparts in the managerial positions in the company. This situation is enigmatic since interaction with persons outside the DP department is essential to success.

The characteristic of low SNS of DP personnel may be the prime factor in the perpetual difficulty in maintaining satisfactory relations with users of DP.

Low SNS on the part of both employees and their supervisors is probably the principal cause for one deficiency uncovered in the national surveys — poor supervisory feedback. Employees at all levels felt supervisory feedback to be inadequate. People who by nature have not communicated a great deal (due to low SNS) need more formal training on improved techniques of communication and feedback.

Implications to Management

The JDS/DP is a device to measure an organization's motivational environment and pinpoint areas needing improvement. We've had the opportunity to apply it in over 70 organizations, including more than 25 government organizations: city, state, and federal. Our national data base now contains information on over 4,000 personnel in 12 different computer jobs. An organization can compare its employee responses to the JDS/DP against these national norms to target motivation improvement.

Managers who have concentrated on technical aspects now need to give equal time to behavioral aspects. Formal training in ways to motivate employees is necessary for most managers whose background has been primarily technical.

The potential for improvement in productivity is enormous. It is a principal way to combat the increasing cost of labor and to better utilize scarce resources.

Managerial and Professional Productivity

J. P. Bolduc
Senior Vice President
Booz, Allen & Hamilton, Inc.

WHY BOOST PRODUCTIVITY?

"Productivity" has become THE word in today's business vocabulary. Strong productivity gains are a prerequisite to a healthy economic climate for business and government. Yet, U.S. productivity remains at a virtual standstill.

One of the prime reasons for the poor overall productivity record of business has been its inability to raise the productivity of "knowledge workers." Offices are the nerve centers of both the private and public sectors. And, the productivity of both sectors hinges on the productivity of their office-based managers and professionals. They are the knowledge workers who create and analyze information and make the key decisions.

Today, white-collar tasks consume over half of business people and payroll. In fact, Booz, Allen studies indicate that U.S. business spends over $800 billion annually to support its office-based white-collar workers. Well over half ($465 billion) of that sum is paid to managers and other professionals.

However, while approximately $50 billion is spent annually on purchased information resources (computers, communications equipment and the like) to aid clerical and other nonprofessional office workers, only $21 billion is being spent on similar resources that support managerial and professional productivity. The need for more substantive, accurate, and timely information is not surprising. In business, as in government, information is power. What is surprising is management's willingness to tolerate a productivity leakage of hundreds of billions of dollars and still come up short in meeting information needs.

With the mounting demands on managers and professionals, and the impact of inflation, the direct cost of white-collar operations could exceed $1.5 trillion by 1990, but we also forecast that as much as $300 billion could be saved annually through the proper utilization of automated office equipment and services.

Recognizing the severe problems created by lagging productivity, Booz, Allen launched a multiclient-funded study in 1979 of managerial and professional productivity. The objective was to determine how U.S. industrial, financial, and government organizations could better utilize new information technology to achieve this potential savings. Since then, the Firm has gathered nearly 90,000 time samples from some 300 professionals and managers in each of 15 representative major business organizations. In addition, senior consultants spent about 100 man-months interviewing, observing, analyzing, and absorbing the culture, behavior patterns, attitudes, and needs of the 15 work groups. These findings were then screened against a comprehensive list of emerging office automation applications and other productivity improvement techniques to select and shape those specific tools that could boost productivity on a cost/benefit justified basis. The result is that measurable productivity and quality benefits to be gained from office automation and other improvements have been isolated and quantified.

No other previous examination of knowledge workers has probed the output, working habits and attitudes of office-based managers and professionals so extensively. The scope of this massive undertaking prompted most leading suppliers of office equipment and services to join in funding the study. These initial supplier sponsors were joined by 15 leading U.S. user organizations — representing manufacturing, banking, government and insurance — which provided the case studies for the project.

Combining the talents of its management consultants and applied systems specialists, it was determined:

- How managers and other professionals are actually spending their time in the course of a day, and how these time profiles relate to specific departmental objectives.
- How managers and other professionals feel about how they spend this time, and in what areas they are receptive to change.
- How and which automated office systems might boost productivity and the quality of "knowledge work."
- How much productivity improvement can be achieved and how much money could be saved by 1985 through better use of office automation and other techniques.

- What magnitude of return on investment could be accruing as soon as 1982.
- The specific types of planning, feasibility, and implementation methodologies and technologies needed to ensure success.
- The architecture by which automated tools are likely to be deployed physically.

The results of this study are crucial to your office productivity planning for the 1980s. The study has wide-ranging implications for businesses and government in all developed countries, since it has focused on departments generic to almost every industry — marketing, personnel, purchasing, operations, information systems, legal, and customer service. Moreover, our consultants studied a variety of office situations — ranging from offices where virtually no automation had been used to those where very sophisticated stages of automation had already been achieved.

TO WHAT DEGREE CAN AUTOMATION HELP?

One of the major objectives of the study was to determine the magnitude of productivity improvement made possible by office automation. Through extensive research and interviewing at each case study site, our analysts determined that knowledge workers spend anywhere from 18% to 30% of their time on less productive activities — i.e., those which do not typically utilize their professional skills:

- Doing clerical tasks — filing, copying, transcribing.
- Trying to find and screen the "right" information and people.
- Traveling.
- Expediting previously assigned tasks.
- Scheduling and organizing their own work.

Moreover, most of those interviewed felt that they would like to spend less time on these activities and were receptive to office automation as a solution.

In addition, the study identified and quantified significant opportunities for improving the quality and raising the productivity of the more skill-related managerial and professional activities — meetings, telephone calls, reading, creating documents, and analyzing.

For each of these activities, the study identified and evaluated some specific gains that can be achieved through automation.

- Audio and video conferences, for example, can reduce travel time and increase participation and interaction.
- Advanced forms of word and image processing can enable managers and professionals to review and edit their knowledge documentation more efficiently.
- New forms of personal computing can enhance and speed the process of making decisions and analyzing quantitative data.
- Access to personal information files, as well as internal and external databases, can provide more accurate and timely information with less effort.
- Automated tickler files, calendars, project and task management systems, information screening, and tracking systems can promote better time management and more effective coordination and control.
- Document image mail (such as facsimile), character-encoded mail, and an even newer development — speech mail — can speed distribution and simplify preparation of messages and other one-way communications.

Each case study contains specific recommendations, depending on individual needs, as to how automated office systems can be put to use. In addition, a summary report was prepared detailing overall profiles and more generally applicable conclusions about which automated tools can yield returns on investment and the most favorable cost/benefit ratios.

Essentially, the study bears out that there are *four major gains* to be made through the proper management of office technology:

1. Improved *quality of work* output in terms of substance, content and thoughtfulness, timeliness and accuracy.
2. Expanded *quantity of work* output — broader scope and coverage, higher yield and absorption of normal growth.
3. *Reduced input time* required to produce the same outputs.
4. Enhancement of an individual's *quality of work life* by allowing more opportunities to participate, less "ugly" travel and fewer interruptions.

By strongly attacking chronic time wasters and raising the quality and productivity of their other, more necessary activities, knowledge workers will be better able to immerse themselves in the four tasks in which they expressed a strong desire to become more involved:

- Analyzing and creating.
- Planning, instead of "putting out fires."
- Expanding participation in the decision-making process.

- Upgrading personal professional skills.

Among the many study results was one, for example, showing that knowledge workers were spending their time by activity as follows:

- 46% Meetings (including Telephone)
- 25% Less Productive Activities
- 13% Document Creating
- 8% Reading
- 8% Analyzing

WHAT BENEFITS DID THE STUDY OFFER?

For the first time, the results of this study clearly substantiate and quantify the "business case" for office automation. Essentially, the study results answer the following key questions:

- How much time do managers/professionals spend on each type of work activity? How much do these activities relate to the products/services they provide? Which tools and types of hard copy do they use and how often? Where is the work done? To what degree is the work planned? With whom do they communicate, and how often?
- How much and in what ways can newer applications of office automation reduce the time and/or enhance the quality of each major managerial and professional activity? What other nonautomated improvements may need to be implemented concurrently with automation to ensure the desired results?
- What is the range of anticipated levels of investment, ongoing costs, savings, and returns on investment? What factors differentiate the most attractive opportunities?
- What pivotal skills and experience are needed to plan and coordinate a long-range knowledge worker productivity improvement effort in a large, diversified business or government organization?
- What methodologies are most appropriate for studying the feasibility in a specific department or location?
- What are the major steps in implementing an automated office system? How quickly can this be carried out? Who should be involved in the implementation process?
- What types of systems architecture are required—i.e., what is the technical shape of the "solution?" How might office automation architecture relate to the current office environment, the current data processing and telecommunications facilities?

The study results further produced the following benefits for the participating organizations.

- The credibility and confidence that result from having a comprehensive blueprint, and the facts needed to marshal the internal support and resources to move ahead aggressively.
- A much clearer and detailed understanding of the relationships between knowledge work and office automation and how these relationships can differ by functional area and even by individual.
- Specific quantitative yardsticks (activity profiles, costs, benefits, ROI) to use in planning and evaluating the feasibility of specific office automation undertakings.
- The ability to isolate those improvements to which end-user managers and professionals are likely to be most receptive.
- Incisive tips and specific methodologies to help organize, plan, design, and implement productivity improvements.

HOW WAS THE STUDY CONDUCTED?

One case study was conducted in each of 15 large U.S. industrial, banking, insurance and government organizations. The specific departments studied included: finance, personnel, information systems, operations management, research and development management, legal, materiel management, purchasing, internal consulting and underwriting. In addition, five case studies dealt with various facets of marketing, field sales and customer service in the manufacturing and financial industries. Each case study was selected jointly by Booz, Allen and the user organization, based on the following criteria:

- *Generic Value* - Representative of similar functions in other larger business organizations.
- *Value to Other Subscribers* - Could contribute to a reasonably comprehensive mapping of a composite "typical" overall organization, in terms of function, organizational placement or geographic distribution.
- *Cooperation* - Senior department managers were supportive of the study objectives and methodology (although individual participants were selected to gain a broad spectrum of those likely to be more and less receptive to change).
- *White-Collar Mix* - Representative of three levels of knowledge workers: senior managers, managers and other professionals.

- *Stability* - Department was in a reasonably steady-state condition; no unusual changes or management/morale problems.
- *Size* - Unit contained at least enough knowledge workers to warrant a case study effort.

The scope of each case study encompassed a detailed quantitative and qualitative examination of the work objectives and related activities of 9-25 directly participating managers and other professionals — nearly 300 in all. Only those automated tools that will be commercially or widely available by 1982 were considered (at their 1982 price/performance levels).

In the course of conducting the study, our professionals spent approximately six man-months on each case:

- Working with department managers to understand the critical success factors of their operation.
- Orienting and interviewing, in depth, case study participants and eliciting their reactions to office automation tools qualitatively and quantitatively.
- Gathering critical data on costs, volumes and other background statistics related to the participants, their activities and the office support systems currently in use.
- Applying a new proprietary methodology to help participants record activities — 3,000 to 8,000 time samples in a three-week period per case study, including self-evaluations of improvement opportunities and techniques.
- Observing individual and group work patterns and behavior throughout the study.
- Eliciting post-study assessments from those who participated.
- Developing an extensive case study report detailing all of the study highlights and recommended management actions.

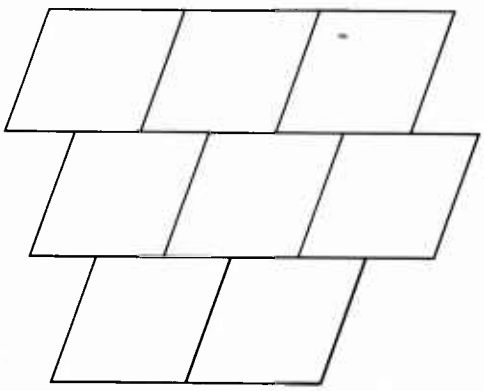
In addition, the team also spent several dozen man-months on background and summary research, analysis and documentation.

This study is unique in its breadth of activities and automated tools covered, its depth of detail and its sensitivity to both behavioral and technical issues.

What is needed in the business and government sectors is the recognition that automated tools if properly studied, justified and implemented, can play a key role in boosting productivity. What is further needed is an integrated and energetic approach to improving the productivity of office-based white collar workers through the successful introduction of office automated tools in concert with behavioral, organizational and procedural considerations. The payoff is there. The initiative is up to you.

Information Resource Management

Chairman: Craig Cook, Ph.D.
Principal, Arthur Young & Company



A Conceptual Framework For Implementing Information Resource Management

Craig M. Cook
Principal
Arthur Young

One of the fundamental concepts underlying the Paperwork Reduction Act of 1980 (P.L. 96-511) is that of Information Resource Management (IRM). The IRM philosophy entails the widespread consideration of information as a valuable, shared, corporate resource with explicit recognition of the value and cost to an organization of its information and related activities. The overt management of this information resource, then, is intended to improve the overall effectiveness of information and to control its cost. Enhancing information effectiveness and establishing accountability for information costs throughout the Federal government are dual goals of the Act which legislates certain procedural and organizational changes in the direction of improved management of Federal information resources.

The purpose of this presentation is to: provide a general overview of information resource management, to describe some fundamental IRM concepts, to relate some common IRM experiences, and to focus on key issues for implementing IRM within a large organization. The material presented is based upon recent effort by Arthur Young in support of several of its clients' movements toward establishing IRM in their own organizations (including, for example, the Department of the Army).

There are many ways to view information in an organization and many ways to assign managerial responsibility for it. Thus, one organization may choose to categorize its information according to the owning component or division while another may separate its information by type, such as strategic, tactical, or management information. Yet a third may divide its information according to subject area, such as personnel, financial, or logistics. Other categorization schemes include: by the medium of the information (electromagnetic, paper, microforms, books), by the form of the information (voice, text, data, image), by the version of the information (official, synchronous copy, current, archival), and others. How an organization categorizes its information can impact the management structures it establishes to manage that information. Thus, many organizations will simultaneously have management activities dealing with vertical information systems, the systems development process, the equipment used in processing the information, data element standards and codes, the reports used to convey information, the forms used to collect information, and on and on. The management of information as a resource cuts across all of these artificial boundaries and views of information to focus on global optimization of the cost-effective collection, processing, and use of information throughout the enterprise.

Information resource management is, itself, a fairly new concept which draws upon numerous managerial and technical disciplines each of which can contribute philosophies, tools, and techniques in support of better information management. Some of the more prominent existing disciplines include information system management, data management, paperwork management, telecommunications management, information sciences management, records management, office management, and the management of other resources (such as money or personnel). Each of these disciplines has its own primary focus and is important to the overall management of an organization. The IRM approach is an attempt to achieve a synergistic impact by improving the coordination among these various disciplines through the establishment of higher-order goals with regard to information and a mechanism to ensure the coordination.

That mechanism is the IRM process, which entails establishing information resource managers to guide, direct, and support the management of information throughout its life cycle: from requirements definition, through collection, transmission, processing, storage, dissemination, and use. The information resource managers serve to coordinate and, to some extent, control the information-related activities of the suppliers, handlers, and users of information within the enterprise. The focus of the information resource managers is a global view across all phases of the information life cycle to reduce unwarranted redundancies, to assist in the use and sharing of information, and to establish an awareness and sense of accountability for overall information costs throughout the organization.

An IRM program basically requires an information-as-a-resource philosophy which must be made prevalent throughout the enterprise, a set of IRM policies and procedures to impart the philosophy and to govern the pro-

gram, an organizational structure (not necessarily a single unit) to plan, implement, monitor, and control the policies and procedures as well as the program itself, and finally, a set of tools (such as standard data elements, data dictionaries, or information locator systems) to assist the planning, implementation, monitoring, and execution process. Agencies intending to move toward the development of an IRM program may wish to perform an information management audit to assess the existence of and degree of coordination among their various IRM program components, to evaluate the shortfalls, and to chart a course toward achieving better cooperation among their information management disciplines. Through this audit and the resulting plan, an agency can determine how best to meet the provisions of P.L. 96-511 while simultaneously achieving its own internal benefits of information resource management.

Some of the benefits which an enterprise can expect to receive by working towards managing its information as a resource include improved productivity of its management and staff through reduced search time and the time normally expended in reconciling inconsistent information from distributed sources; more effective operational decision-making, planning, and resource management by improved information quality, timeliness, and accuracy; and simultaneous increased responsiveness to demands for information and decreased reporting burden on the field components which supply the original data through better organization and inventorying of available information. In general, an agency, by moving toward information resource management, will seek to establish better control over its information costs and the costs associated with information system development, use, and conversion. Through establishing an IRM program an agency can expect to be in an improved posture for transition to the cost-conscious environment of the 80's.

The Paperwork Reduction Act of 1980

Warren Buhler
President
Management Design, Inc.

OMB Director David Stockman has termed the Paperwork Reduction Act of 1980 one of the most important reforms in government management since the Budget and Accounting Act of 1921. He argues that the Act is the first major attempt by the Federal government to manage and control Federal costs imposed on the private sector. This presentation describes the flow of events that led up to the development of the Paperwork Reduction Act and the opportunities the Act presents to information managers in the Information Age. With its emphasis on information resources management, the Act will require some fundamental policy management and operating reforms for ADP.

There were a number of forces which led to the development of the Paperwork Reduction Act. One of the predominant forces was the fact that information handling today is managed by at least five independent programs: ADP paperwork reduction, statistics, records management, and the privacy/FOIA program. Each of these programs has a government-wide policy group and offices in each agency. Top policymakers and managers in the Federal government have experienced the inability of these various groups to work together for the good of the agency. There were a number of reports from professional groups that cited serious problems such as: the President's Reorganization Program report for ADP, which noted that the Federal ADP program had excessive operating costs, unneeded acquisition costs, degraded services, and was inadequately supporting our national defense.

There also have been a number of environmental changes that have affected the operation of government information programs. These include rising and identifiable: information costs, increasing lack of effectiveness, seeming abundance of technical opportunities, programmatic needs for ever greater information capabilities, management needs for greater information capabilities, and a seeming convergence of information technologies. These problems may be summarized as a loss of direction in the various information professions such that, information managers were more interested in serving their own bureaucratic needs rather than program objectives; a narrowing professional focus-away from the frontier spirit of 20 years ago to an almost professional myopia; and, an increasing tendency to operate independent fiefdoms, rather than being policy and management team players.

In addition to these professional interests in the Paperwork Reduction Act, there was a number of political interests expressed during passage of the legislation. Obviously, the genesis of the legislation was in bringing paperwork under greater management control. A number of questions were raised as well about the relationship between paperwork and regulations; a decision was made to put paperwork management and information management under one organizational roof in OMB so they could be coordinated. ADP and statistical issues were felt to be an important coordinate to paperwork management and these were included under the information resources management umbrella, in spite of some opposition. Finally, a strong issue was raised about the extent of OMB control, and in the end, Congress reaffirmed the central management responsibility of OMB for ADP policy.

The Paperwork Reduction Act sets new policy directions, requires new organizational alignments, and, requires new procedures for controlling information activities.

The policy direction in the Act is clearly focused on agency mission and program objectives. There is a shift in focus away from procedures, such as ADP procurement. The Act requires information resources government-wide. The resource management perspective places ADP and other information managers within management teams responsible for utilizing information and other resources in the most efficient manner to accomplish program objectives. Finally, the Act sets a number of new management and control policies for information, none of which are outside traditional planning, budgeting, management and oversight activities normally associated with other resources, such as dollars and personnel. However, these management and control policies have not been clearly stated with regard to information activities in the past.

OMB has already moved to create the new organization required by the Act. It has established an Office of Information and Regulatory Affairs headed by Jim Miller, who has the title of Administrator. Jim Tozzi is the Deputy for that Office. The Office will be responsible for information resources management, reports management, statistics, records management, privacy and ADP/telecommunications policy. Of course, it is also handling regulatory policy.

All agencies except for the Department of Defense are to assign similar information management responsibilities to a single individual. Under the Act, DoD can assign these functions to several individuals but they must all report to the agency head and have their responsibilities delineated.

The Act sets out several new procedures, the most important of which is implementing information resources management on an agency-by-agency basis and government-wide. In addition, the Act calls for three-year audits of all information activities, annual reports to Congress on information resources management in the agencies, and major cuts in agency paperwork requirements imposed on the public.

The Act goes on to list several tasks and deadlines for OMB and the agencies. By April 1, 1982, OMB: shall have published audit standards and requirements for information activities, shall have established the Federal Information Locator System and, shall have developed plans to eliminate duplication. By April 1, 1983, OMB shall have published: information resources management standards and requirements, a five-year ADP/telecommunications plan, a productivity plan for government based on a better use of information technology, information processing standards, a plan for resolving differences in privacy confidentiality and Freedom of Information Act policies, and shall have acted on all recommendations of the Commission on Federal Paperwork. The Act also requires a 15 percent reduction in Federal paperwork requirements imposed on the public by October 1, 1982, and an additional 10 percent cut by October 1, 1983.

OMB is still formulating its plans for implementing the Paperwork Reduction Act. At this point, OMB intends to release guidelines by April 1, 1981 on the appointment of a single individual for information activities on the "Paperwork Clearance" process, and on clearance of agency information policies and procedures. OMB also intends to develop task forces on: information audits, the ADP telecommunications plan, information resources management policies and requirements, and improving Federal programs using information technologies.

In conclusion, the opportunities for information managers resulting from the Paperwork Reduction Act are: to better serve policy and program officials, to increase top policy management attention to information activities, and to improve career progression into top agency/management positions. The Information Age indeed provides opportunities, not sure bets for those involved in ADP and other information programs. It will be those individuals who were best able to see how information activities might better serve agency policy and program objectives who will make it to the top. Information management with the Paperwork Reduction Act can become a central policy and management job in the Federal government.

The U.S. Army Information Resource Management Program

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This paper presents a brief overview of the Army's Information Resource Management (IRM) Program and the office which will support it. Most of the thoughts presented herein remain in the conceptual phase. Over the next six months these concepts will be further expanded and refined.

In August of 1978, the Army issued a Request for Proposal for a study the purpose of which was:

> ". . . to develop policy, doctrinal concept, methodology, procedures, and an organizational structure to be used by Department of the Army to accomplish Data (Information) Management for, and within, HQDA and its supporting Data Processing Installations (DPI's)."

A contract was awarded to Arthur Young on 27 September 1978. The study sponsor, the Office of the Assistant Chief of Staff for Automation and Communications (OACSAC), chaired a Study Advisory Group of representatives of various Headquarters, Department of the Army (HQDA) agencies to direct the study effort. The study was conducted in two phases. Phase I included a study of and a definition of the problem and, Phase II was conducted to develop a proposed solution. Recommendations were presented by the contractors in February 1980. The study was limited to automated information at HQDA, and all study findings and recommendations were formulated within these bounds.

In Phase II of the study, the contractor proposed a way in which an Information Resource Management program could be implemented. The results of the study were staffed throughout HQDA, and when final agreement was reached, a decision memorandum on the formation of an IRM program for the Army was forwarded to the Vice Chief of Staff, Army (VCSA). The VCSA approved establishment of an IRM program in June 1980. His approval included:

- Implementation of an IRM program with the designation of the Director of Management (DM), Office of the Chief of Staff, Army (DCSA) as the head of the program on Information Resource Management Administration (IRMA).
- Establishment of a provisional Information Resource Management Office (IRMO) to be headed by a Colonel staffed with 2 Officers, 2 Civilians, and 1 Administrative Specialist.
- Tasking of the DM to prepare the necessary implementing instructions.

Colonel William A. Bradley, Jr., was appointed as the Chief of the IRMA and assumed his duties on 28 July 1980. Other personnel were assigned to IRMO in July and August. The initial staffing included two officers from the Office of the Director of Management, one officer from the Office of the Assistant Chief of Staff for Automation and Communications, one civilian from the Office of the Adjutant General (TAGO), one civilian from the U.S. Army Management Systems Support Agency (USAMSSA) and, one enlisted Administrative Specialist. This initial staffing was considered representative of the agencies that would be most involved with the implementation of the IRM program.

The IRMO charter, contained in Chief of Staff Memorandum (CSM) 81-11-4, stated that up-to-date, accurate and readily available information is essential to accomplishment of the Army mission. This information is a resource in the same sense that people, facilities, material and dollars are resources. Like other resources, there are costs associated with the production of information as well as values which must be placed on the information resource. Unfortunately, information has not been managed as well as other Army resources, and therefore, does not yield the maximum return on the information production effort. This is evidenced by the lack of knowledge of what information is available, where it can be found, who collected or produced it and how accurate it is. Information is frequently duplicated rather than shared. Duplicative systems have been developed due to a lack of knowledge about available information. The cost of information production coupled with the increasing competition for Army dollars necessitates an end to uncoordinated and fragmented information management.

The IRM Program will approach the management of the information resource using a life cycle management

approach in the same manner that many other Army resources are managed. Information can be characterized by a six-phase life cycle consisting of: requirements, planning, data collection and update, processing use, and disposition. It should be noted that the IRM Program, as being implemented by the Army, pertains to the management of all information, and not just automated information. The IRM Program is not another computer or management information system. It includes all sources and types of information, such as records, forms and manual reports as well as automated information. IRM is concerned with the entire information spectrum.

Many Army programs are already in existence for management of portions of this Army information spectrum. The ACSAC has programs relevant to the management of automated information and TAGO has for years managed the Army manual and administrative information systems. While these programs have been focused within themselves, there has been no overall program to harmonize these efforts. The IRM Program will be built on existing programs and their management structure. The existing programs will become the key subprograms of the new capstone IRM Program. Some subprograms which will be brought under the IRM umbrella include: information planning, information systems coordination, forms management, records management and information inventory control.

The challenge to the IRMO is to insure that subprograms goals and objectives are coordinated to meet the goals of the overall IRM Program. The IRMO will manage the Planning Program, and initially manage the Inventory Program. Since the Inventory Program will eventually be operational in nature, it will be assigned to another agency for implementation after concept definition by the IRMO.

The information life cycle will provide the unifying thread for drawing all of these supporting subprograms together. The IRMO will develop a model to define and manage the information life cycle. In addition, the IRMO will provide an overall plan and policy for the IRM Program based on the information life cycle model. Finally, the IRMO will provide a costing methodology in support of the life cycle phases. Using this information, the subprogram managers will tailor their programs to support the model.

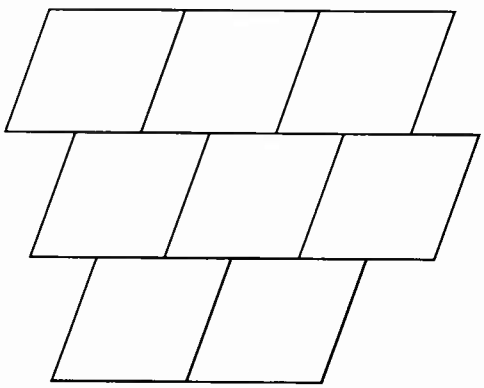
As with any program, control will be necessary to monitor and manage the program. Control will be achieved by establishing approval authorities for each phase of the information life cycle. Multiple approval authorities will be designated for each phase with the actual approval authority selected based on predefined cost or importance thresholds. Thus, for a simple information requirement, approval of an immediate supervisor may be all that is required. On the other hand, approval for the requirement for a major information program may require HQDA approval. This is in conformity with the approval processes for management of our other Army resources. The IRMA, as the senior official responsible to the Chief of Staff for Information Management, can adjust approval thresholds to either tighten or loosen the controls of information.

IRM is a new and continually evolving technology in itself. The Army implementation and adaptation of the program represent new approaches within this new technology. Thus, it will not happen overnight. Many questions need to be answered, many issues need to be resolved, and many concerns and fears addressed. The IRMA and IRMO realize this and will move cautiously in the implementation of the program. Program objectives have been written and tentative milestones applied which permit evolution into the IRM concept rather than an Information Management revolution.

The ultimate measure of success of the IRM Program will rest with actual test cases. IRM concepts are being tested on a number of ongoing HQDA projects and initiatives. For example, IRMO is working with OACSAC and TAGO to provide a central automated authoritative data source for use by the CSA and heads of ARSTAF agencies. An integrated network tying together traditional automation, office automation and telecommunication for the entire headquarters is under conceptual development. While the initial thrust of the program is aimed at HQDA, both IRMA intent and that of the Paperwork Reduction Act require that the program be expanded to encompass the entire Army. The current plan is to prove the value of the system at HQDA and then modify it as necessary for implementation throughout the Army.

Trend Projections and ADP Policies for the 80's

Chairman: Rhoda Mancher
Deputy Assistant Attorney General, Department of Justice



Computers: Key To Productivity In The Eighties

Frank R. Kline, Jr.
Vice President - Research
Drexel Burham Lambert, Inc.

Computer technology is the keystone of an unfolding industry, the information processing and handling industry, that we expect will become all-pervasive in the years and decades ahead, impacting the way in which offices, factories and personal lives will be run. This new industry is the result of two large businesses coming together; namely, computers and communications. Viewed as a key infrastructure of the eighties, this merger, in our opinion, will dramatically change the way we distribute, process and receive ideas and information. In this presentation, we examine in detail the growth prospects for the various market participants in the areas of:

- Office Automation
- Factory Automation
- Home Automation

Computer technology since its birth in the late 1940s has contributed greatly to the economic development of the U.S. and it has caused the emergence of an industry that, from an investor's point of view, has been particularly attractive. The question at present is: What does the future hold for this industry and where are the emerging growth opportunities?

Between 1964 and 1979, the effective cost of computer technology declined at an average annual rate of 27.8%, while between 1970 and 1979 the pace quickened, dropping 33.6% annually. We feel certain that this trend will continue unabated over the next five years, because there are a number of new technologies emerging that will push computer processing into a new price/performance strata. Some of these new technologies include the following:

- The semiconductor industry is moving into the next generation of component technology — *VLSI* or *Very Large Scale Integration* — where chip densities will increase to 256,000 bits of storage, facilitating improved system reliability, improved performance and lower cost per gate. This will happen in the 1982-1983 time period.
- Data-packing density will increase as companies move from the metallic medium of secondary storage to *optical mediums*. Here, bits per square inch will move from 107 to 108, with a dramatic drop in cost. Semiconductor lasers will bring new economics to storage, not only in the data processing arena, but in the home, office, educational, government and factory environments.
- The availability of *high-level languages for microprocessors*, such as Fortran, COBOL and Pascal, will be common, facilitating the translation of symbolic language into machine-language instructions and cutting months from software development time.
- *Very high-level nonprocedural languages* will take hold in the 1980-85 time frame, allowing the user, to write his application program and to get the required results in minutes and hours, rather than days and months.
- *Standardization/modularization* of microprocessors and LSI chips will lead to more standard operating systems and common protocols, easing software costs considerably.
- *Magnetic bubble memories* (1-4 Mbit) will become commonplace and offer greater capacity than semiconductor memories — although slower. These low-cost memories will probably approach the cost-per-bit of flexible disks around 1984. They will provide nonvolatile storage in harsh environments, such as a factory, an oil rig or in a laboratory, where tape and disk storage devices have been subject to failure.
- *Fiber optic technology* in the 1980-1985 time horizon offers new economics for transmission of digital information over strands of glass. In intelligent printers/copiers, it will allow the linking of high-speed machines with word processors, computer terminals and enhanced office systems.
- *Satellite network technology* will be initiated over the next few months and years, which will transfer data, messages, images and voice at 6.3

million bits per second—a dramatic increase over today's land lines that run at 56,000 bits per second and less. On the ground, local area networks, consisting of wide-band coaxial cable, microwave, radio and communications transceivers, will be implemented, linking diverse manufacturers' computers, peripherals, office equipment and terminals, ensuring compatibility.

- *Voice synthesis and recognition technology* will open up new horizons for effective man-machine interface. Already voice boards have been introduced in banking and manufacturing applications. Speech synthesis and recognition technologies have overcome high costs and technological constraints, making their introduction possible. Between 1982-1985, voice input/output (I/O) devices will rapidly find their way into industrial, consumer, aerospace, defense and office systems, enabling easy access and easy use of computer power.
- Decreases in physical size and in power consumption of all components will result in savings in both energy and real estate. New technologies, such as *gas plasma displays*, will save on office space and lend themselves to cramped office environments.
- *Advanced function workstations* will incorporate data, text, voice and graphics, allowing for cost-effective information handling from a single point. The incorporation of advanced functions, such as handwritten text recognition via scanners and touch-sensitive input devices, will make man-machine interface as easy as pointing a finger and bring processing power to applications that were too complex for traditional I/O devices.

From the foregoing it is clear to us that the computer industry will continue to enjoy a very elastic demand environment.

Macro-Forces

Coupled with this market-driven behavior, there are three macro forces at work which combine to make investing in computer/communications-related companies especially attractive at this juncture.

First, the rate of technological improvement, which we estimate at around 25-30% per year over the long term, will almost certainly continue to outpace the annual rate of inflation over the next five years, both in this country and in other post-industrial economies.

Second, the data processing industry is merging with the word processing and the communications processing industries to form an Information Processing/Handling Industry, offering major opportunities for current participants, as well as for spinoffs and new ventures. We look for the merger of present technologies through new software and communication mediums and the development of new cost-effective systems for voice mail, office processing, electronic filing, teleconferencing, factory assembly and others.

The third, and perhaps the most important force from an investor's point of view, is this country's declining rate of productivity growth compared to countries such as Japan, West Germany and France. With few exceptions, such as in the computer and semiconductor industries, the rate of productivity growth peaked in the mid-1960s. Total research and development expenditures declined from a 2.9% share of Gross National Product in 1964 to 2.3% in 1976 and 1977—an approximate 20% decline.

This disturbing trend is the result of a combination of factors: the rapacity of OPEC; the continuous shift from a manufacturing to a service-oriented environment; the declining rate of young people entering the work force; government regulations and tax laws that discourage innovations; changing attitudes of American workers, with a corresponding decline in output per employee; the fear of capital shortages; and, the long-term movement from a labor-surplus to a labor-scarce economy.

The needed productivity improvement will result from the use of the following inputs:

- Education
- Tangible Capital
- Economies of Scale
- Improved Resource Allocation, and,
- Technological Innovation.

Edward F. Denison, a former Senior Fellow of the Brookings Institution, after examining the sources of growth and the contributions made by each of these components, determined that technological innovation appeared to be the largest source of productivity gain. The National Science Foundation, which funded the Brookings study, concluded that computer processing power surpassed education and resource allocation in contribution to total output.[1]

We are also convinced that the key to productivity gains in the years ahead is technological innovation, particularly in the area of energy and computer/communications. It is our belief that over the next five years there will be a dramatic increase in emphasis by employers on spending for labor-saving and cost-effective technologies that enhance productivity. This translates into computer processing power.

Already, management has turned its sights on information processing/handling devices that have achieved remarkable productivity gains, such as CAD/CAM devices, word processors, text editors, voice mail systems,

teleconferencing systems, robots, small/interactive desktop computer units and computer generated graphics. This is only a sampling of the systems that have been proven to be true aids to productivity enhancement.

Over the next few years, we believe there will be many market segments within the information processing/handling industry which will see dramatic growth because of their products' and services' demonstrable labor saving potential. New technologies will also emerge, opening up new markets and opportunities for investment.

The preceding macro technological trends generate exceptional growth prospects for the various market participants in the areas of:

- Distributed Data Processing
- Office Automation, and,
- Factory Automation.

These trends led to the exchange of equipment and services valued at $71 billion in 1980. By 1985, we look for this figure to be well over $250 billion for computer-based information processing and handling firms.

While there are many potential participants in the information processing and handling industry, only those companies will survive that can properly harness and assemble systems to meet the needs of the eighties in office and factory environments and that can properly service and educate users of these products. There is no question in our mind that shake-outs in the various market segments will occur. The economics today are not the same for the computer industry as they were in the past. It is our conviction that software and service (people) will be the key to the industry's future success, while hardware availability will be a given.

1. National Science Foundation Grant 75-23131 to the Brookings Institute.

DoD Digital Data Processing Study — A Ten Year Forecast

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The "DoD Digital Data Processing Study - a Ten Year Forecast" was performed by an industry team under the auspices of the Requirements Committee, Government Division, Electronics Industries Association (EIA). The results of the year-long study were initially presented at the EIA Fall Symposium, "The DoD Electronics Market - Forecast for the 80's," which was held in Los Angeles on October 7-9, 1980.

The hypothesis behind the study was that an ever-increasing share of the DoD electronics budget is being earmarked for digital computers. The industry team, with representatives from Control Data Corporation, IBM, Intel, ROLM Corporation and TRW performed an analysis of the digital computer portion of the broader DoD electronics segment. The study included both Automated Data Processing (ADP) and the embedded computer area; it included both hardware and software/services.

The study team used multiple sources to obtain and verify information including: DoD budget data, congressional testimonies, over 40 personal interviews with experts in industry, DoD, congressional staff, OMB and GSA, periodicals, industry market research publications including Frost and Sullivan, DMS, Quantum, et al, and published data from several government sources including OMB, GSA and GAO.

The quantitative and qualitative results of the study are presented in this report. In summary form, a few of the highlights from this report are: (Unless otherwise stated all dollars are current in billions.)

- Defense electronics will increase from $20.1 in FY80 to $75.7 in FY90. Defense computers will increase from $6.7 in FY80 to $45.8 in FY90 - from 33 percent of Defense electronics in FY80 to 60 percent by FY90.
- Software and services (S&S) will increase from $4.6 in FY80 to $37.2 in FY90 - from 69 percent of the total Defense computer expenditures in FY80 to 81 percent by FY90.
- Software hourly rates have nearly tripled since 1965 and are projected to be over five times the 1965 base by 1990. However, the cost of computer hardware is *decreasing* dramatically. By 1990, the cost of large mainframe computers and the cost of mini/micro computers are projected to be one-fifth and one-tenth respectively of the 1965 base.
- In 1955, there were approximately 1000 computers and 10,000 programmers, a 1:10 ratio in the U.S. Today, there are approximately 900,000 computers and 240,000 programmers, a 9:24 ratio. Even with productivity improvements, the shortage of qualified software personnel will not end; software costs will continue to rapidly escalate.
- During the 1980's:
  - The total DoD budget will increase 2.8 times,
  - The DoD electronics budget will increase 3.8 times,
  - The DoD computer budget will increase 6.8 times,
  - The DoD software budget will increase 8.1 times.
- ADP computers in Federal inventory will increase from 16,513 in FY80 to 58,070 in FY90. ADP computers in DoD inventory will increase from 6,435 in FY80 to 27,700 in FY90. During the 1980's, minicomputers will comprise a large portion of the Federal/DoD inventory. DoD's ADP hardware budget is forecast to increase from $.8 in FY80 to $2.7 by FY90; during the same period, the DoD software and services budget will increase from $1.8 to $5.2.
- The ever-increasing DoD ADP budget combined with nearly constant in-house personnel levels results in an increasing percentage of DoD's

ADP budget going to the private sector, as shown below:

FY	DoD ADP $ To Private Sector	% of Total ADP $ to Private Sector
1978	$ 926 M	48
1979	1,224 M	53
1980	1,482 M	57
1981	1,688 M	59

- Embedded computers are defined in the study as specially designed, for example, designed to satisfy MIL-Specs, and are acquired as part of a total weapons package, thus "embedded" in a weapons system. It is not generally recognized by most personnel in the computer field that embedded computers presently represent over 60 percent of the DoD computer budget, and the percentage is projected to increase to approximately 75 percent by 1985 and 83 percent by 1990. Microprocessors will have an ever-increasing influence in the embedded area; much more so than in the ADP area.
- Single chip microprocessors capable of performing a million instructions a second (1MIP) are forecast to be developed during the early 1980's.
- It is forecast that in the coming decade, nearly every weapon system will have an embedded computer (or computers) somewhere in its control subsystem and/or C^3I subsystem.
- A larger portion of the embedded budget is returned to industry than from the ADP budget. An estimated 87 percent of the 1980 embedded budget was contracted to industry, most of which came from RDT&E accounts with a smaller portion from O&M and procurement accounts. There is a definite trend for the services to function more and more as program managers executing contracts to industry in the embedded area as opposed to performing computer design/development tasks in-house.
- It appears that "DoD Digital Computers" and Defense electronics are becoming synonomous. Digital computers are 33 percent of electronics in 1980, and will become 43 percent in 1985 and 60 percent in 1990. In addition, as we might suspect, the software and services portion of Defense computers is growing much faster than hardware, growing from $4.6B (69 percent) in 1980 to $37.2B or 81 percent of the total in 1990.
- Another factor is the shortage of computer programmers. There were approximately 1000 computers and 10,000 programmers in 1955; by 1980 there are approximately 900,000 computers installed in the U.S. with only 240,000 programmers. We predict that the shortfall in programmers will become worse and create additional pressure to the spiraling cost of software and, of course, the Federal government and DoD are vying for the same software resources as industry.
- Let's now examine the ADP and embedded markets in greater detail. First, let's look at the ADP market.
  - First, the number of computers or CPUs. There were 8983 CPUs in the Federal inventory in 1975 with 47 percent or 4245 belonging to DoD. In the post-Viet Nam era, DoD's ADP inventory increased to 6435 CPUs by 1980, a decline in percent of the total Fed. We are predicting that this trend will reverse and DoD will have 13,594 CPUs in inventory by 1985 and 27,699 CPUs (many of these will be minicomputers) by 1990 which will be about 48 percent of the total in Federal inventory.
  - Budget-wise, DoD's ADP is running at about 50 percent of the Federal ADP budget. From $1.5B in 1975 to $2.6B in 1980 and our forecast calls for a continuation of the 50 percent trend for a DoD budget of $4.5B in 1985 and $7.8B in 1990.
  - The DoD ADP budget for hardware is forecast to increase to $1.5B by 1985 and to $2.7B by 1990, but S&S will increase more rapidly to nearly $3B in 1985 and to over $5B by 1990.
- To summarize this data, during the 80's:
  - The DoD budget will increase by a factor of 2.8,
  - The DoD electronics portion will increase by a factor of 3.8,
  - DoD computer costs will increase by a factor of 6.8 and,
  - DoD software costs will increase by nearly an order of magnitude (8.1 times)!
- I would like to conclude the ADP portion of this presentation with a few predictions and trends which seem apparent. In software, more computers mean more lines of code; this fact plus more maintenance costs times the programmer shortfall is going to continue to force software costs up. Currently software costs about $50 per line of code, and nearly two-thirds of software expenditures go for maintenance. To counter

Training - Computer proliferation in the military inventory has created a training and logistics support problem.

Software Personnel - The continuing proliferation of economic computer systems and the development of more sophisticated and complex systems will cause the demand for software personnel to become acute. At present, the escalating demand for computer systems personnel in private industry and the all-volunteer force concept has begun to create manpower shortfalls in the military services. Faced with more attractive compensation by private industry, keeping qualified software personnel in the military is a serious problem.

Hardware - In embedded computer hardware, there is a trend to move from standardizing at the "box" level to higher, non-hardware levels such as Instruction Set Architectures (ISA's) which could include accreditation/certification of hardware devices at a higher level.

Software - A strong movement toward high level performing languages.

Logistics - The trend is toward hardware box level replacement.

In conclusion, efforts to standardize in the embedded computer area have focused in the past on hardware devices such as the AN/UYK-20 or AN/AYK-14. The next level of standardization deals with the Instruction Set Architecture with hardware implementation/standardization of secondary importance. The trend, of course, is to standardize at higher levels such as the Ada HOL and associated operating system software. With the appropriate set of tools it is conceivable that the HOL level could be implemented with a variety of ISA's and hardware devices.

This concludes our "DoD Digital Data Processing" report.

Trend Projections and ADP Policies For The 80's

Whit Dodson
Domay Corporation

This presentation gained momentum from the conference luncheon remarks made by the Honorable Jack Brooks, Chairman of the House Committee on Government Operations, about the new administration's "recent rhetoric" concerning budget cuts and its likely self-fulfillment. The then newly issued White House memorandum, dated January 22, 1981, which announced a temporary moratorium on the procurement of ADP equipment was presented. The generally surprised audience had questions answered by Mr. Fred Dietrich of the Office of Federal Procurement Policy (PFPP) who predicted that the Office of Management and Budget (OMB) implementing instructions would be signed out as soon as Mr. David Stockman was confirmed as Director. OMB Bulletin No. 81-9, Subject: Moratorium on Procurement of Certain Equipment, was issued on January 30, 1981, with a requirement in it that each agency submit to OMB a plan for reduced Fiscal Year 1981 obligations no later than February 17, 1981.

The balance of this paper was organized around the recent and predicted ADP economic and acquisition trends which arise from: the "Brooks Act" of 1965, the "Paperwork Reduction Act of 1980", and, the GAO report about Federal computer obsolescence.

The Brooks Act

Significant changes were presented from the rewritten General Services Administration (GSA) "Brooks Act" regulations which were effective January 15, 1981. Both Federal Procurement Regulation (FPR) 1-4.11 and Federal Property Management (FPMR) 101-35 are discussed.

The FPR 1-4.11 changes included threshold increases in the automatic or "blanket" delegations: from $35K to $50K for Commerce Business Daily (CBD) notice of intent to order ADPE from a GSA schedule contract; from $300K to $500K purchase price or $12.5K basic monthly rental value for ADPE solicitations based on normal competition; to no limit for software orders from schedule contracts or $100K with normal competition; and, to no limit for ADPE maintenance ordered from schedule contracts or up to $200K annually with normal competition.

FPR 4.1101(b) confirms the "Brooks Act" jurisdiction over government contractors when the *very subject* of the contract is ADP services and the government requires: purchase of ADPE for its account; title to the ADPE or software will pass to it; or, when the government reimburses full cost of the ADPE or software.

FPR 1-4.1102-1 expands the scope of ADPE within "Brooks Act" jurisdiction to include typewriters which utilize paper tape or magnetic media, word processors, and data transmission or communications equipment designed for *primary use* with ADP. For the first time it clearly excludes from "Brooks Act" jurisdiction over general purpose ADPE products which are modified during production, if thereafter: they have no commercial market; cannot process a variety of problems; or, can only be used as an integral part of a non-ADP system.

FPR 1-4.1109-12 authorizes the submission of agency procurement requests (APR) to GSA for compatibility limited requirements to augment or replace existing ADPE looking forward to a normal system life. Such compatibility limited APR's should be approved by GSA if they are supported by a software conversion study and based on mission essential requirements for continuity of operations plus avoidance of risk and lost opportunity. In addition, economy, efficiency, and positive steps to enhance future competitiveness should be predicted. By contrast, the new FPMR 101-35 abolished the old interm upgrade program which approved compatibility limited requirements for a fixed period pending recompetition.

FPR 1-4.1109-13 provides for software conversion studies. The software conversion studies are not required when: there is no current software; only peripherals are required; or, only to exercise the lease to purchase option on installed ADPE. Software conversion studies are required when: the ADPE requirement is estimated to equal $2.5 million or greater (excluding maintenance and support costs); or, the cost of conversion is used to justify a sole source greater than $300K.

FPR 1-4.1109-14 provides that conversion costs should be evaluated during an acquisition when they include: programs written in existing FIPS or ANSI high level languages; programs written in non-standard language

which are to continue essential operations without redesign; on-going FIPS or ANSI high level developments; CODASYL data bases and systems; or, direct conversion expenses such as site preparation, retraining, and parallel operations. In addition GSA authorizes the evaluation of other costs incident to a conversion period; such as: lost productivity; continued rental and operations; use of essential outside services; or, delayed implementation of mission cost reduction systems or programs. On the other hand FPR 1-4.1109-14 directs that evaluated conversion costs *exclude:* mission essential program or system designs; purging obsolete data and programs; or, developing normal program documentation.

The Paperwork Reduction Act

The Paperwork Reduction Act of 1980, Public Law 96-511, states in its body that it neither increases nor decreases the authority of OMB, GSA, or the Department of Commerce (DOC) under the "Brooks Act". It can be readily anticipated, however, that based in part on statements made on the floor of the Senate during consideration of the Paperwork Reduction Act of 1980, and in part on certain DoD exemptions from the Paperwork Reduction Act that user agencies, particularly within DoD will frequently contest the earlier Brooks Act demarcations. Significant section by section issues of the Paperwork Reduction Act of 1980 are discussed below.

Section 3502 removes from the scope of the Act activities concerning: intelligence, national security cryptologic, direct command and control, weapons or weapons systems, and, critical military or intelligence missions. On the other hand, it specifically included within its scope DoD routine administration and business applications such as: payroll, finance, logistics, and personnel management.

Section 3503 establishes within OMB the Office of Information and Regulatory Affairs which apparently will be delegated all OMB functions for both the "Brooks Act" and the "Paperwork Reduction Act of 1980".

Section 3505 specifies express functions to be performed by the OMB Office of Information and Regulatory Affairs some of which include ADP and telecommunication management significance such as: develop, in consultation with GSA, a 5-year plan for government-wide ADP and telecommunications requirements; establish multi-agency audit teams for major information systems except for those involving criminal investigations, intelligence activities, and cryptologic communications security; and, enforce FIPS standards, particularly software language standards.

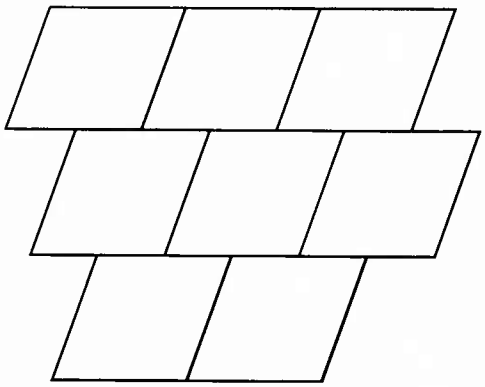
Section 3506 directs that each agency appoint a senior official who reports directly to the agency head and that this senior official be assigned responsibility for the *conduct of* and *accountability for* the Brooks Act delegations of Authority.

GAO Report AFMD-81-9

The ADP computer obsolescence findings and recommendations of GAO Report AFMD-81-9, dated December 15, 1980, contain potentially the most significant acquisition policy position in recent years. The GAO report presented well known average statistics about the Federal ADP inventory, but then *it recommended immediate action.* In lieu of the traditional hand wringing about the overly complex acquisition cycle, it recommended *prompt compatible replacement of economically obsolescent computers.* It found that continued operation of government owned computers can be uneconomic, even if cost comparisons are made against short-term leases for the technological upgrades. The overall study and recommendations deal with economic obsolescence, functional obsolescence, and physical obsolescence. The report specifically recommended that: OMB and GSA encourage immediate replacement of economically obsolescent equipment without extensive studies; the user's agency audit verify cost calculations; replacements be program compatible; agencies should not wait for GSA to issue regulations but immediately make economic studies and agree to implement software FIPS and plan future competitiveness; and, agencies should make long and short range plans, improve top managers' ADP knowledge, increase top management involvement, and use full cost accounting in life cycles.

Office Automation

Chairman: J.P. Bolduc
Senior Vice President, Booz, Allen & Hamilton, Inc.



Office Automation Equipment

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A wide variety of different types of equipment are used for office automation applications, including terminals, telecommunications gear, and computers of every size. This diversity poses a real challenge to managers, who must wade through the morass of technical specifications in search of cost-effective solutions to real problems. Despite the continued decline in the prices of automated equipment, hardware costs still represent a significant portion of office automation systems. In order to cut through the morass of features, managers should focus on services to be performed.

Three examples of services that are commonly provided by office automation systems are: document production, electronic mail, and activity management. These services can be provided individually by discrete systems, or together by an integrated system. Each service provides some of the following types of benefits to office productivity:

- Reduced elapsed time, by transferring information more rapidly, reducing waiting time, and permitting tasks to be performed in parallel
- Reduced aggregate labor, by eliminating tasks or reducing the time to perform them
- Improved quality, by improving the accuracy, timeliness and physical appearance of written products
- Improved job satisfaction, by automating the menial and repetitive tasks, eliminating or reducing "ugly" travel, and providing workers with the tools to do their jobs more effectively.

Document production services are the most common form of office automation in use today. They are particularly useful in situations where there is frequent revision of textual content, where proofreading is performed at each stage of production, where standard "boilerplate" text is frequently incorporated in documents or where identical documents are produced for multiple recipients, and where material is presented in different formats or produced on different media (such as being typeset). By maintaining textual information in automated form from the first keystroke, significant improvements can be achieved at all stages of the document production cycle. Revisions can be entered without retyping unaffected portions of the document (and without introducing new errors). The changed document can be reformatted automatically and printed at high speed for review. The revision process can iterate as many times as necessary, and even last minute changes can be accommodated quite easily. When final, the document can be printed or typeset in the desired format with such added attributes as right margin justification, if desired.

A variety of different equipment configurations have been used to provide document production services, including:

- Stand-alone word processing stations, originating with the IBM magnetic card/tape selectric typewriter and represented today by the "electronic typewriter"
- Intelligent workstations, single user systems with display screen, keyboard, internal processor with editing software, and removable storage in the form of a flexible or "floppy" disk
- Shared logic systems, in which a single, specially designed processor supports a cluster of user workstations
- Computer time-sharing, in which document production services are provided by a general purpose computer accessed through a remote terminal.

All of these configurations provide functionally similar services, though there may be significant differences in ease of use, available storage, and value-added features such as spelling checkers and complex formatting/editing capabilities. Costs may also differ widely depending on the number of users and volume of usage.

Another common type of service for office automation applications is electronic mail. However, electronic mail does not refer to a single type of service, but rather to a variety of systems where information is sent electronically from person to person. Such systems include:

- Direct terminal to terminal communications, such as TWX, Telex and communicating word processors

- Facsimile, providing for terminal to terminal transmission of full images
- Mailgram and Intelpost, by which character-encoded or facsimile transmissions are made to a Post Office or other central location for physical delivery to the end recipient
- Computer-based message systems, in which character-encoded messages are transported through a network to an electronic "mailbox" in a central computer, from which the recipient can retrieve the message at a later time.

All of these services are based on telecommunications facilities of some kind. Both facsimile and the use of computer-based message systems are growing at quite a rapid rate, though the growth of electronic exchange between word processors is being retarded by a lack of standards for representing information in machines of different manufacture. All of these systems improve office productivity by reducing wasted time such as uncompleted phone calls, reducing interruptions, and reducing the amount of clerical efforts required of professionals.

A third category of office automation services is activity management. This refers to the use of automated systems to help managers and professionals better control their day to day work. The range of services includes:

- Calendar/scheduling service
- Directories of information
- Personal data bases and access to shared data bases
- Tickler or reminder service, and,
- Calculator and computer modelling service.

These services are frequently integrated with other types of automated office services such as the document production and electronic mail services. When the majority of managers and professionals in an office are all able to use these services and to exchange information among themselves in automated form, the resultant productivity information improvements can be quite dramatic.

In reviewing the range of equipment offered to provide these services, a number of trends can be noted. Office automation equipment is increasingly:

- Digital, constructed from low cost computer components
- Intelligent, containing an internal microprocessor and able to modify its behavior in accordance with user directions
- Communicating, able to accept external data and exchange information with other systems, and,
- Modular, capable of being expanded as user needs grow.

This diversity of new capabilities in office automation equipment poses both an opportunity and a challenge. Managers faced with selecting systems and equipment for their organizations will want to begin by focusing on the service that the system will provide. Then features of different equipment can be evaluated in terms of added value to the service. Factors such as ease of use, compatibility with other equipment, and the availability of maintenance and training from the supplier should not be forgotten. The final selection of system components should not be delegated totally to technicians. Dealing effectively with the new opportunities of office automation is a managerial problem requiring managerial solutions. Equipment by itself is not a solution, but may become part of a solution when incorporated into systems including equipment, people and procedures.

The Organization — A Living System — Implications For Office Automation

Joyce C. Doria
Principal
Booz, Allen & Hamilton, Inc.

In the past, managers have looked at office automation in terms of choosing appropriate applications and hardware configuration. Decision making and planning revolved mostly around these concerns and were handled primarily by automation and computer technology specialists.

Experience of the last decade, however, has taught us some difficult, though valuable, lessons in this area which would encourage us to view office automation from another perspective — the organization as a living system.

This presentation will elaborate on the viewpoint that the organization is a living, dynamic system which will make or break your efforts in introducing office automation. I will illustrate the inherent abilities of an organization to reject change, and I will identify those impact factors that will determine whether you succeed or fail in office automation implementation.

Lessons Learned: System Characteristics

As office automation gains greater momentum, we must take heed of some generalizations which are based on experience.

First and foremost, office automation represents a significant change to the organization, and usually a very threatening one. Secondly, the people in your organization will control it, support it, manipulate it, or defeat it depending on your implementation strategies. Thirdly, the system, like all technology, is neutral; what you do with the system is what is significant — which is why you need to remember that the system should serve people and not vice versa. Finally, the system will be complicated by the people in your organization; therefore, you need to define early any potential problems and begin creating solutions to facilitate the implementation.

ORGANIZATIONAL CHARACTERISTICS

The organization, on the other hand, functions differently from the office automation system. It is neither neutral nor static; rather, it is an entity with a definite personality, values, norms, and style. The organization will respond either positively or negatively to any changes in its environment, depending on how it is treated in the process of change.

Any manager implementing office automation must be aware that the system configuration must fit the organization environment and its culture and, thus, its people. The importance of this fit is illustrated in the following case study regarding the implementation of a $3 million system in a federal agency which failed, because the manager was not tuned in to the environment of the organization.

CASE STUDY

Agency Goals

The particular agency in this case study had several goals regarding office automation that are typical in most organizations, i.e., to increase communications between the national and field offices; to improve professional staff utilization; to reduce staff costs; and, to comply with support staff personnel ceilings. Finally, the agency also recognized the need to increase workload capability in the future, especially regarding correspondence, reports, and case preparation.

Agency Characteristics

This was an investigatory agency with a large national office, and regional and area offices. It had recently been reorganized. The national office was responsible for program and policy formulation, while the field offices were responsible for compliance. The field operations were highly autonomous. The politicization of the agency was divided — the national office was most affected by activities on the Hill, while the field offices were affected by local government politics.

The professionals in this agency were highly experienced and tenured, reflecting the technical expertise required for the type of regulatory/investigatory work undertaken there. In addition, the agency was strongly unionized.

System Configuration

The manager chose a system configuration based on the goals he outlined for himself. He initiated teleconferencing for the national and regional offices to increase communications and reduce travel. However, he neglected to include the area offices, which would benefit the most from teleconferencing since they had little contact with the national office.

The manager also chose to install communications terminals, but limited their use to top-level executives. Unfortunately, those who were the decision makers had less need of them than managers at the operational level.

In addition, the manager installed word processors for all staff use. However, this highly centralized operation created problems for the national office where 3,000 people were served by the system.

Organization Reaction to System

Support staff complained of overwork and of malfunctioning equipment. Secretarial and clerical personnel who had been transferred to word processing filed grievances because they felt the move was not consistent in grade level with their previous positions. Personnel discontent resulted in union grievances, high turnover, and physical fatigue and stress. Employee work attitudes were adversely affected by the system. Morale was low, resulting in higher turnover, additional recruiting costs, and increased EEO and union grievances.

Professionals, too, were dissatisfied with the new system and claimed that the quality of products was poor, that the system lacked sufficient capability, and that their previous secretarial support was preferable to a centralized production area. The field office professionals complained of not having terminal access and teleconferencing capability and, in general, felt "taken in" by the national office.

The managers were frustrated with the situation and claimed that the system did not meet their needs for increased communication, that it was too complicated to understand, and that it experienced frequent breakdowns.

Results of Implementation

The overall result of this implementation was the underutilization of a system that cost $3 million. The productivity and quality of work/life was down. The organization was hostile to the system.

The negative reactions expressed by the field offices reflected their frustration that the national office had not involved them in any decisions regarding implementation of a system that they were now forced to use.

ORGANIZATIONAL INFLUENCE IN SYSTEM IMPLEMENTATION

The problems generated in the case study could have been prevented if the organization had been analyzed in terms of its formal and informal sources of influence. For example, formal structure of the organization was heavily centralized, with the national office controlling policy. However, decentralization by location and program offered the field offices and program directors an opportunity to effect and even modify policy when they chose. The manager of the automation implementation did not consider the informal structure when he made the system decisions.

In terms of the power sources, it is often the "old timers," the career employees representing the "institutional memory" of an organization who have more influence in an organization than the traditional sources of power, i.e., the political appointees close to the Secretary. Yet the opinions of the careerists were not solicited regarding a new automation system; and, consequently, they did not support its introduction in their offices.

In the same light, the unions and staff needed to be considered outside the traditional structure of an organization. The union need not have been viewed as generally anti-management, but rather as potentially supportive in specific issues, such as opportunities to improve career paths of union employees through office automation. The staff, too could have been seen not only in terms of professional contributions, but as individuals or groups who could assist in implementing change through their individual contacts and relationships with other employees or managers.

IMPACT FACTORS ON AUTOMATION

In addition to analyzing the organization in terms of its formal and its informal structure for areas of influence, an implementation approach should consider other factors for success. In the organization itself, the level of trust, management commitment, and the perceived value of the change from all organizational levels are significant factors.

The characteristics of the employees should be assessed in terms of their overall profile (age, sex, education, tenure), and their fears regarding change. A formal impact factor analysis would consider these issues, gauge the quotient for tolerance for change within the entire organization, and serve as the basis for designing an implementation approach.

OFFICE AUTOMATION IMPLEMENTATION METHODOLOGY

Any approach for introducing office automation should include several steps to assure a successful implementation. A multidisciplinary planning team should be developed consisting of representatives not just from multiple skill areas, but from the various structure, power, and influence sectors. This type of team would include executives, program directors, secretaries, union leaders, automation managers, and a Human Resources Management expert. These team members should represent all persons who will be impacted by office automation. One way this team can best contribute to an implementation plan is through action planning meetings for decision making.

Worker Profile

A second step should be to formulate a worker profile to anticipate employee perceptions and reactions to office automation. Again, the data generated from this profile would be valuable in the implementation plan. For exam-

ple, older and more tenured employees would be more likely to resist a system than younger and more recently employed personnel. This information should be incorporated into the implementation strategy.

Training

Thirdly, training should be offered to accomplish three major objectives: to demonstrate the utility of the system; to demonstrate the system features, procedures, and applications; and to achieve technical confidence in the users of the system. This training should include sessions on skills development and attitudinal adjustment and should involve all levels of professional, management, and support groups.

Managing Change

Implementation strategies need to consider the degree of complexity that will be introduced to the organization as a result of change, and the time frame allowed for the implementation process. The organizational trust level will affect the treatment of these issues. In addition, the amount of disruption and the changes of the worker's role must be addressed. Job redesign, expansion of autonomous work groups, and coaching and counseling can ameliorate the negative effects of change.

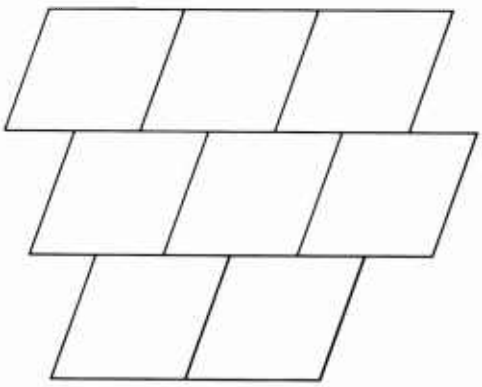
Reducing Fear

Finally, specific steps can be undertaken to reduce the strong fear of automation that is inevitable in most organizations. These activities include designing systems that are people-oriented; reducing the jargon and technical complexities associated with automation; minimizing disruptions; and increasing sense of competence through training.

It should be remembered that the most perfectly designed system which is rejected by the organization is a failure. Design of the automation system is the abstract game plan; implementation is the game itself. The extent to which the plan addresses the dynamic character of the living organization will determine the outcome of the effort.

Program Management

Chairman: Brigadier General William E. Thurman
USAF, Commandant, Defense Systems Management College



The VIABLE Procurement

COL James E. Love, USA
Program Manager
VIABLE Project Office
U.S. Army Computer Systems
Command

Project VIABLE, an OMB Circular A-109 acquisition, is a high priority joint initiative by the Army Staff and selected Major Commands to procure ADP resource support for approximately 47 sites throughout the continental United States, Alaska, Hawaii and Panama. The sites are for the most part Base Operating Systems utilizing IBM 360's. The current ADPE performs the non-tactical administrative, logistical, and financial processing for the management of Army installations. These basic Army business functions are now being performed with equipment that is marked by obsolescence, growing maintenance problems, and capacity limitations that often do not enable timely processing of the daily workload and could not accomplish these functions for an enlarged force under mobilization conditions. The VIABLE procurement will alleviate these limitations by accomplishing the following major objectives:

- Obtain a fully open and competitive procurement.
- Obtain the latest technology.
- Relieve the ADPE saturation at selected BASOPS sites.
- Overcome the maintenance problems with the current system.
- Support mobilization requirements.

VIABLE is being procured within the guidelines of OMB Circular A-109 which was written to give impetus to industry in providing solutions to problems faced by government agencies. The methodology to achieve this goal requires early involvement of industry in the acquisition process. Reliance on the private sector and competitive consideration of innovative solutions is an integral part of the acquisition. Given the ownership/operation possibilities, Government Ownership/Government Operated (GOGO), Government Ownership/Contractor Operated (GOCO), or Contractor Ownership/Contractor Operated (COCO), the spectrum of feasible solutions ranges from ADP service centers to mini computers located in the functional areas at each site.

Following extensive project reviews by OSD, GSA and the House Government Operations (Brooks) Committee, the Army released an OMB Circular A-109 Request for Proposal (RFP) on 27 March 1980. On 30 January 1981, proposals were received from industry in response to the VIABLE RFP. The number, quality, and sources of proposals from several teams of highly qualified vendors indicate a strong level of competition which has the potential of producing an advanced technical solution within reasonable cost estimates.

The evaluation of industry proposals will be conducted by the VIABLE Source Selection Evaluation Board. This Board consists of technical experts who will evaluate contractor proposals and produce summary facts and findings required for source selection. The evaluation will be conducted in two phases. Phase I is designed to evaluate all proposed concepts and solutions for compliance with requirements as stated in the RFP. Phase II is a demonstration phase. Here, contractors will demonstrate the effectiveness of their proposed solutions in fulfilling VIABLE requirements. As an example, the government will pay each contractor to convert approximately 10% (some 200,000 lines of COBOL program code) of the Army's standard systems from ANS 68 COBOL to ANS 74 COBOL as a means of assessing the quality of the automated conversion tools and the contractors' conversion procedures. The converted systems will then be used in various capacity and effectiveness demonstrations. The final source selection will be made from those contractors who have successfully completed the Phase II demonstration.

Selected milestones and completion dates are:

Event	Date
Proposals Received	Jan 81
Evaluation (Phase I) Completed	June 81
Live Test Demonstrations (Phase II) Completed	Feb 82
Contract Award	June 82
Lead Sites Delivered	Aug 82
Production Deliveries	Sep 82 - Sep 84

Applying Program Management to Data Automation Development Projects

COL Richard A. Lejk, USAF
Deputy Chief of Staff, Logistics
Management Systems
Air Force Logistics Command

I am the Deputy Chief of Staff for Logistics Management Systems for the Air Force Logistics Command at Wright-Patterson AFB. My office came into being on 1 October 1980. It was the result of the realignment of the data automation functions from under the Command Comptroller and the program management functions from under my previous office. The purpose of this move was to eliminate much of the confusion and overlap of the separated functions, relieve the Comptroller of automation responsibility so he could concentrate on monetary issues, and set up a single Command spokesman for automated data processing issues.

As a result, I am dual-hatted—the Logistics Management Systems Program Manager and the Command ADP Program Single Manager. My fiscal year 1981 budget totals $125 million. I have direct control over slightly more than a thousand people at Wright-Patterson and indirect control over an additional 2200+ people spread across our five Air Logistics Centers and two special centers.

Applying program management and its concepts to data automation development projects is relatively new within the Air Force Logistics Command. My original office, mentioned earlier, came into existence only in March 1978. As many of you know, our Command had a couple large, well-publicized "problems" in the 70s. Thus, to get the Command's logistics management systems moving and to restore our credibility, the Commander set up an organization to bring program and project management to the data automation community. We were not then nor are we now the requirements initiator or validator. Our charge is to take the validated requirement and move out smartly to give the worker in the warehouse, airframe fabrication shop, or jet engine repair facility a system that will meet his needs.

A significant part of program management within the Command is done through a project coordinator function within one of the smaller offices of my organization. This Office of Project Management enforces the interface between the functional user and the data automation development staff. The coordinators pay constant attention to the major projects assigned to each of them. They are my eyes and ears and have a very direct chain and open door to my office.

They also enforce strict compliance with Department of Defense and Air Force standards for development, documentation, and reviews. Of significant note is a concept you will hear around AFLC: it's called, "Primary of the User." Basically what it means is that once a major project comes on the books, we look to the user community to provide the project manager. We don't want to forget the reason for the project in the first place. We then select a qualified data processing person to be his deputy. These two people, once colocated, become the nucleus of the project managment office and the building with more talent (permanent and matrixed) begins.

The project management office, with support of the coordinators mentioned above and the supporting user and data automation people, build the plan and make the commitment. We publish relatively detailed milestones for our people, the Air Staff, and Congress to see. We publish it twice a year and update internally during the off quarters. Throughout the year, at least once for each major project and also after major phase points, our projects undergo review by me and, again at least once a year, by the Commander or Vice Commander of Air Force Logistics Command. That is an indication of the high-level interest our projects generate . . . three- and four-star time is important.

Let me give you an idea of the roles and relationships that are present in our program management concept. The project managers, as the name implies, have the overall project responsibility. It's up to each one to control resources and meet the cost, schedule, and performance parameters for the project. They probably helped set them. The deputies are responsible to the manager and are the major liaison with the development community—the data automators. The deputies talk the automator's language and often come out of the organization that will do the bulk of the systems work on the project. Together the manager and deputy define and assign the work. They execute the memoranda of agreement and employ whatever techniques are necessary to plan and control their project. In order to control, they must track and report their progress during our Action Plan updates and scheduled reviews. Their authority comes from me through a phased approval process. We approve from major mile-

stone to major milestone, thereby avoiding the 95%-complete syndrome.

By now, you're probably wondering what tells us we have a major project. Back in 1978, we set up some criteria and have stayed with them. To be a candidate for major project status—I say candidate because there is a cost of project management and not every job needs it—a project must break one of the following thresholds: needs 15 or more man-years to complete; increases ADPE lease/maintenance costs by $200,000 per year; needs contractual services funds of more than $500,000 per year; or, needs executive level visibility or attention. Once recognized and approved by the AFLC corporate structure, the concept takes over and project management is in effect.

So everything is rosey? Not always. We still have some items holding us back. Our Command still lacks some credibility. Those around us haven't yet forgotten our failures and still provide some "oversight." The skills problem within the Command is real. Earlier failures took many of our young lions and pushed them out the door. Our antiquated technology base, IBM 7080s, CDC Cybers, and IBM 360/65s, make qualified talent hard to find and harder to keep. The people who have been with us for some time have been tied to these older computers. Theirs has been the real dedication.

All in all, we have a challenge. We are improving our management, our people's skills, and our hardware base. There's a light at the end of the tunnel and it is getting bigger and brighter.

Managerial Considerations for The 1980's

COL John W. McGinnis, USA
Program Manager
Project TRIMIS

In the 1980's we will see more rapid technological change than was witnessed even in the 1970's. This will be especially true in the medical arena. However, is there any difference as we enter the 1980's than there was as we entered the 1970's? As we entered the 1970's we were faced with: a new generation of hardware, expanding data base technology, mini-computers, micros which were at the edge of the state-of-the-art, and distributed systems which were only being discussed. Therefore, as we enter the 1980's we anticipate more technological changes which may possibly come at a faster rate than ever before.

It is my belief that a strong, flexible management foundation supported by requested automated tools, which can accommodate both technological and user changes is the key for the survival of any major government program during the 1980's.

If one is to take advantage of the opportunities that new technologies offer, then a program must possess the analysis tools and assessment strategies that permit the evaluation of the feasibility of each new opportunity. These evaluations must not only be in terms of user acceptance, but also in terms of cost/benefit and cost effectiveness. Coupled with this assessment strategy, managers will require a sound, well tested methodology for conducting risk analysis of the alternatives for each new opportunity.

To compliment this evaluation/risk analysis strategy, a major program must have a flexible planning base. This planning base must reflect the budget process which in turn will support plan accomplishment. If life cycle management principles are to be adhered to, the plan must also support DoD standardization where applicable. It must also permit the testing of each application and its alternatives to document user satisfaction and cost effectiveness. Finally, it must provide a mechanism for review and approval from the user community to senior Defense officials.

One of the stated goals of the TRIMIS Program is to provide systems to our medical health care team users that do not require additional ADP support personnel at the work station. When one compares this stated goal with the level of education that the all-volunteer military structure has given us to work with, it is apparent that we have to develop systems that are simple to operate and yet extremely complex in the manipulation of the data involved. Achieving this goal requires a strong emphasis on training and compiling users manuals at appropriate levels of comprehension so that health care team personnel can understand and operate the systems.

As an example, the TRIMIS Program has an Automated Pharmacy that performs: drug-to-drug interaction analysis, medication profiling, allergy screening, label preparation, continuous inventory management, controlled drugs management, automatic pill dispensing, an IV Additive mixture program, and, a management report capability. All that is required of the pharmacy technician is to input the patient's social security number and verify his/her identification; simple, yet very complex.

As we enter the 1980's, how does program management maintain momentum while coping with such items as: changing procurement policies, changing personnel policies, continuous internal/external reviews, audits and finally, contract inflation values?

Everyone has the same problems with competitive procurement policies. First there are too many. Second they are too confusing and cumbersome to enable program managers to achieve stated goals in a reasonable timeframe. However, these policies are a significant force to be reckoned with in the 1980's if we want to take advantage of the technological changes that are forecasted. Therefore, we must see some new procurement policies which will free the program manager's hands in the 1980's if real progress in dealing with and taking advantage of these new technologies is to occur.

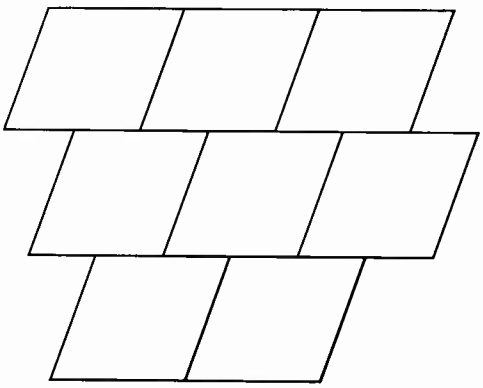
Of course, we all have to deal with changing personnel policies. This is a fact of life, particularly here on the Washington scene. However, it does make managing a large program very difficult in view of continuous cuts, freezes, and new personnel management systems that have to be accommodated into organizations that already face the routine problem of riding the organization of nonproductive people. Unless some ways are found to permit the infusion of new, possibly higher priced, talent into the ADP arena, in a more reasonable time period, we will not be able to compete favorably with the private sector in the 80's.

Finally, how do we cope with contract inflation in the 1980's? I believe it is a foregone conclusion that with all of the managerial limitations that have been placed upon the government under the new administration that more and more, we will have to use outside contractual help if significant achievements are to be attained in the early 80's. With the contractors acquired in a competitive manner, this usually gives one a fairly decent cost for the first couple of years under the contract. However, once the contractor understands the program strategy and can enunciate it in terms of the various projects that he is addressing on your behalf, then you have the problem of contract growth. Thus the question is, "How will one manage this growth in the 80's?" There is no single solution to this particular problem except to be fully cognizant of the situation. When one sees the situation beginning to develop, boundaries must be placed around the project or set of projects and a new contractor should be acquired through competitive procurement. While this may not be the best alternative because the new contractor has to come up the learning curve, experience has shown that if you do this once or twice industry's awareness is increased. Therefore, you may have a strong tool for deterring contract inflation because of the ever present risk of contract cancellation.

In summary, I would like to restate that as a Program Manager, I do not believe we are going to see anything new or revolutionary in terms of managing ADP change in the 80's in comparison to managing ADP change in the 70's. I believe there is a consensus that the technology changes will come at a more rapid pace than anything we experienced in the 70's and, that the industry as a whole may resemble nothing we can even imagine. However, in the end it is the managers who shape that vision. Managers must have the requisite tools to manage these automation projects. New disciplines and new techniques will be required that provide managers with more reliable, accurate and timely data on which they can evaluate the alternatives of each opportunity. This will be the crux of managing ADP technology changes in the 80's. That is, finding managers who understand these new techniques and who can develop the strategies and requisite flexible planning bases that permit accommodation to new technologies without causing significant delays and/or program cost growth. That is the challenge of the 1980's.

Management/Technical Considerations

Chairman: Clem Grabner
Director, Office of Advanced Systems, Social Security Administration



Trends in Software Development

Bernard J. Bennington, Ph.D.
Assistant Commissioner for
Software Development
General Services Administration

This presentation begins by showing a number of trends in software development. These trends illustrate a growing problem with software that is of increasing concern to ADP practitioners. One concept that works against us is the traditional software development model. A more pragmatic model is described and a series of first steps in improving current systems are presented.

Hardware Cost vs. Software Costs

Over the last decade we have seen total ADP costs in the government rise approximately 16 percent in real terms. Within this, there has been a trend of the costs shifting from hardware to software. There has been a so-called, thousand fold increase in hardware productivity in the last two decades whereas the process of producing computer programs is still largely labor intensive. There has been little increase in productivity in producing computer programs - perhaps the only significant increase coming from the introduction of high level languages two decades ago.

Personnel Costs

In the last decade there has been very little increase in staff years applied to ADP within the government. However, there has been a significant increase in the cost of these resources. Costs have almost doubled in this time. With increased competition for scarce programmers both externally and internally within the government, we can only expect the costs to continue increasing.

The Maintenance Plateau

Given that software costs are an increasing portion of the ADP budget and that we can foresee this trend continuing, there is a second, and perhaps more disturbing trend. Over the last two decades an increasing portion of software resources has been devoted to maintenance. It is estimated that fully two thirds of software development resources today are involved in correcting errors in systems or making changes to extend the system life. Less and less resources are available to examine new ways of doing things and to examine the potential for automation of non-automated processes. This trend, termed the maintenance plateau, is one of the main inhibiting forces retarding progress in use of ADP.

New Program Development

The picture is equally dismal if we examine the products from the investment of resources in new application programs. The General Accounting Office examined nine software development contracts totalling $6.8 million. They found that nearly half the software delivered could never be used successfully ($3.2 million). Almost an additional quarter of the software paid for, was not delivered ($1.95 million). Almost a further quarter ($1.3 million) was used for a time, but had to be extensively reworked and was later abandoned. Only 1.75 percent of the software contracted for could actually be used as delivered.

Although these figures may not be entirely representative of actual percentages governing development of all new programs, there is a general consensus among the ADP community that development of large systems is a very uncertain process and a highly risky business when the operational health of an entity relies upon such a project.

Summary

These trends would not be so disheartening if software were not so intrinsically important. First of all, the effectiveness of all hardware is a direct function of the effectiveness of the software. Secondly, there is a much more critical relationship between the mission effectiveness of an agency and the effectiveness of ADP support (and therefore software). In essence, the effectiveness of major segments of the government are dependent upon software which is the neglected and increasingly problematic issue of ADP.

System Development

One concept that works against us in software development is the overly simplistic concept of a system development life cycle in which there is a progression of discrete tasks from feasibility study, preliminary design, through coding and testing to eventual operation. It is the appealing simplicity of this model that is its downfall. It is taught to every ADP practitioner and, worse, to every non-ADP manager during their computer concepts training. It is written into processes and procedures, into regulations and policies and is so generally understood to be correct that a project risks condemnation if it does not follow this

logically appealing structure. The problem is that rarely, if ever, does the real world of ADP correspond to the world described by the model.

Actual situations, i.e., actual projects require a much more sophisticated set of approaches. The following model is one such approach that admits that: most major ADP organizations today have a decade or more of investment in software, that their organizations are almost entirely dependent on that software, that keeping that software operational is a difficult enough job and that deviating from that baseline of software is an uncertain and risky business. With all these constraints, organizations still need to support new applications to keep their costs competitive or their service levels at the high standard increasingly demanded by the public.

Software Development Process

The universe of software from which a desired application can be built can be conceived as a triangle. At the apex are all of the programs that *currently exist* and run the operation today. At the bottom left hand corner are *other operational programs* that exist in other organizations. Finally, at the bottom right hand corner are programs which do not yet exist and must be engineered as *new programs.*

Each of these sources of programs has well defined characteristics and natural hierarchies of attributes exist around the points of the triangle. For example:

- The *current programs* which are operating in your organization to a certain extent must be satisfactory to your users so that you are successfully meeting your mission. Admittedly there may be many faults with these programs. For example, they may represent second or even first generation thinking, they may still be processing files in a sequential manner when you require instant access to the data, or they may be structured around a previous generation of obsolete machines and thus may be a maintenance or performance nightmare. Nevertheless, by the very fact that you are a successful organization, they are accomplishing the functions that you need to conduct your day-to-day business. Therefore, they have an intrinsic value.
- *Other operational systems* that are already developed and exist in the business world or inside different agencies of the government are potentially usable to form your desired application. They may suffer from the detriments mentioned above, but also systems may exist which are highly maintainable, well documented, and quite portable. This is certainly going to be true for some commercial products offered in the competitive market place.
- *New code* can be specified and built from scratch. This theoretically can be the most maintainable and best fit to your application, but is also difficult to engineer.

If we now look at the hierarchy of attributes:

- *Accuracy:* Your *current programs* have an inherent advantage in that they are the only source of code of the three where you can generate existing test data, move that code into a new environment whether it be a new hardware architecture, a new language, a new processing philosophy, or different ways of handling data, and still be able to map data back field by field to prove the accuracy of the programs.

  Next in the accuracy hierarchy are *other operational systems* where you may be able to generate data for part of the system and test the accuracy. Finally the least accurate source of code for your desired application is *new code* where there is no test that you can measure back to.
- *Cost of developing the code:* The cheapest per line cost to produce a line code for your desired application comes from converting lines of code which exist in *current programs.* A range for these costs is approximately between one and ten dollars a line to produce code for the desired application. The cost depends on: whether we are moving simple COBOL to a similar architecture, are moving assembler languages, or are moving from file systems to data base. In moving code from *other operational systems,* this range of cost could vary between five and twenty dollars a line of code for the desired application. And then, finally, the price for *new code* seems to vary from ten dollars a line to as much as six dollars a line.
- *Maintainability:* The hierarchy of maintenance costs runs the opposite way. The most expensive code to maintain would be *existing programs,* especially if you had to move low level language programs into your desired application. The least expensive to maintain should theoretically be *new programs* which could be engineered using structured programming techniques and assuring complete documentation.

These attributes are illustrative of a much longer list that could include risk factors as well as cost or benefit factors.

Planning Under the New Model

The construction of a new system now becomes one of assessing the source of program materials against the costs and benefits of each attribute and hence develop-

ing a strategy for the transfer and integration of those into the new system. Typical steps would be:

- Identify requirements and what is possible.
- Develop conceptual system design, then detailed design.
- Specify new files, programs, data sources, interfaces.
- Identify existing processes to be retained.
- Plan the transforming and mapping of those into the new system.
- Plan the installation of software packages.
- Plan development of any necessary new systems.
- Convert the retained systems.
- Integrate the packages.
- Build and test the new components.
- Test the complete system.

The Difference from Conventional System Development

This approach has two basic benefits:

- It minimizes uncertainty and risk by maximizing the utilization of testable components.
- It allows the project to be broken down into small, manageable pieces with a working system at each phase.

Under the so-called conventional model, all of the resources are poured at once into tasks with hard to quantify milestones, giving little feedback before all the resources are spent and causing great difficulty in predicting completion.

Under the discussed model with its inherent advantage of incrementalism, each step can be small and hence manageable and, where existing test data is available, can be validated by computer. By utilizing this approach, the project complexity is reduced, a new version of the system is operational at each stage and the investment in the past is preserved as far as possible.

Limitations on the Development of Requirements For Large Scale Systems

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There are many large organizations both inside and outside of DoD that may be characterized as "information intensive" — i.e., where information is a primary product and there is substantial benefit to the overall mission effectiveness from the rapid movement and integration of information. The decision making and operational structure of such information intensive activities have most likely been shaped to accommodate the limitations of the current information processing technology. Fundamental changes in the decision making and operational structure, therefore, are often a necessary prerequisite to achieving the optimal benefits from the use of a more advanced technology.

System development methodologies, however, focus attention almost exclusively on the determination of requirements in a *current* management/operational context and thus implicitly assume that the current decision making and operational structures will remain substantially unchanged. This factor has contributed to the failure of many large systems to improve the mission effectiveness of large information intensive activities.

"Classic" systems development methodology demands a sequential approach in which information *requirements* are *first* determined to be used as a firm basis for the later development phases. The validity of this approach implicitly rests on two basic assumptions:

- "Information requirements" of an activity/process are largely determined by the intrinsic characteristics of the activity/process itself, and,
- The characteristics of the activity/process are distinct from and essentially independent of the means used to meet its information requirements.

It is this isolation of information requirements from the means used to achieve them that permits the sequential approach of the "up-front requirements" methodology:

- First, the set of "users" determine their information requirements based primarily on their individual knowledge of their activity/process.
- Second, the "technicians" design and implement the "best" means of meeting these information requirements based primarily on their knowledge of information systems technology.

Most activities/processes, even highly complex large ones spanning multiple organizations, probably fit this model fairly well. Within that class of activities/processes which in fact do meet the underlying assumptions, the "classic" approach is correct in asserting that the larger, more complex, and wider-spanning that they are, the more significant the benefits gained from insisting on the sequential approach of this methodology.

It must be recognized, however, that there are activities/processes for which the underlying assumptions do not hold. One type of discrepancy occurs in circumstances where the cost of acquiring and processing information may influence an evaluation of its utility. The common characteristic identifying these activities/processes is that the introduction of a capability to meet a requirement may disturb the assumptions under which the requirement was initially perceived. A trivial but illustrative example is furnished by the typical office's "requirement" for extra copies of incoming documents. Until the introduction of xerography and related technologies significantly lowered the cost and difficulty of obtaining such copies the "requirement" for them was almost non-existent. Even though the intrinsic characteristics of how the office functions may not have changed, the "requirement" for large numbers of such copies was created by the economic and technical feasibility of obtaining them. Other examples arise in cases where the capabilities offered by ADPE fundamentally affect how an activity/process is performed — e.g., banking, insurance, etc. This type of situation is not at all uncommon in cases where the essence of the activity/process is itself the manipulation of information. In extreme cases, the activity/process may in fact even have been created to perform a new function that was not previously possible without ADPE support. In these circumstances, it is evident that the "information requirements" are in effect a product of characteristics of the means of implementation, and not the reverse as is assumed by the "up-front requirements" approach. It is the substantial "feedback" that exists between the capability and the requirement

which compromises the isolation of requirements from the means used to achieve them.

Even if the essence of the activity/process is itself shaped by the technology supporting it, there still may be circumstances in which you could successfully apply the "up-front requirements" approach:

- If the activity/process is not unduly large or complex
- If the users have a working knowledge of the technology
- If the impact of the introduction of the new methods does not significantly alter the distribution of responsibilities and authority among the organizations involved in the activity/process, *and,*
- If the introduction of new methods and technology does not carry significant technical and management risks.

It is conceivable that the necessary consensus and management endorsement could be achieved on the "rethinking" of the entire activity/process in terms of the new economics and capabilities at a level of detail sufficient to derive meaningful information requirements. However, unless *all* of the above factors are present, the use of a purely sequential approach to determining "information requirements" is not likely to be successful for activities/processes where a substantial capabilities/requirements feedback exists.

As can be seen from the above, it is the magnitude of change induced in the fundamentals of the activity/process itself by the introduction of new ADP technology that is the primary cause of difficulty. If the change is very large, the existing framework of methods, procedures, distribution of responsibilities, etc., does not offer a sufficiently static functional framework for the a priori determination of information requirements. One must, in fact, be able to determine in detail an entirely new way in which the activity/process should optimally function in light of the new capabilities and economics before information requirements can be defined. Not only is this a significantly more demanding task in and of itself than a "traditional" information requirements analysis, it requires simultaneous knowledge of the intricacies of the activity/process (how can it be performed differently) as well as of the technology (how can the new way be supported, what are the costs, risks, etc.), even to propose meaningful candidates for analysis.

Classic systems development theory has yet to develop a systematic approach in this type of situation. Until it does, a pragmatic manager would be well advised to adhere to the following principles:

- Realize you're in this type of situation.
- Recognize that induced changes in procedures and distribution of management responsibilities is most difficult and a fundamental aspect of problem.
- Focus management attention on this aspect, i.e., organize it as a management/procedural change project; not as an ADP systems development project.
- Resign yourself to "staged" implementation — attempt to minimize number of stages and amount of "re-development".
- Do not project changes in procedures and distribution of responsibilities beyond your ability to determine *detail* requirements for next stage without undue risk.
- Devote resources, when necessary, to pilots to gain information needed in subsequent stages.

Life Cycle Costing and Life Cycle Management

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In recognition of the need to better manage its large ADP programs, the Department of Defense has recently emphasized the application of Life Cycle Management (LCM) to its automated information systems (AIS). The Office of the Assistant Secretary of Defense (Comptroller), Directorate of Data Automation (DDA) initiated DoD directive 7920.1, Life Cycle Management of Automated Information Systems, to implement Life Cycle Management for these programs. The directive, issued in October 1978, has the following objectives:

- To insure management accountability for the success or failure of major automated information systems
- To establish a control mechanism to insure that an AIS is developed, evaluated and operated in an effective manner at the lowest total overall cost
- To provide visibility for all resource requirements of an AIS and communication with Congress early in the acquisition process
- To promote cost-effective standardization of the automated information system management and planning process.

Due to the magnitude of DoD ADP resources, and the criticality of the functions supported, Life Cycle Management is essential to the access of major DoD ADP programs.

One of the most important elements for the successful implementation of Life Cycle Management is the establishment and use of standard Life Cycle Costing (LCC) procedures. The ability to accurately and consistently estimate life cycle costs is essential to the LCM concepts of accountability, lowest total overall cost, and system cost effectiveness. The development of Life Cycle Costing procedures has also been recently emphasized by the September, 1980 issuance of OMB Circular A-121, "Cost Accounting, Cost Recovery and Interagency Sharing of Data Processing Facilities." The emphasis in this circular is on the identification of the full cost of ADP resources. Finally, a recent report by the Defense Audit Service has found that while some progress has been made in implementation of LCM, attention should continue to be focused on cost estimating techniques to achieve LCM objectives.

The Directorate of Data Automation, in recognizing the need for improved Life Cycle Costing within the context of DoD Directive 7920.1, has recently initiated several study efforts. The objectives of these efforts are to:

- Encourage the application of consistent Life Cycle Costing concepts within the context of Life Cycle Management
- Identify and resolve conflicting LCC/LCM terminology in an effort to improve communication and understanding between the various DoD components and the oversight organizations
- Identify techniques to improve cost estimation within a consistent LCC framework.

The initial results of these study efforts have provided significant insight into the current status of Life Cycle Costing within DoD. Further, a glossary of terminology used in LCC/LCM has been developed as well as an extensive bibliography of LCC/LCM documentation and information.

Current Status of ADP Life/Cycle Costing

A review of the current application of LCC in DoD indicates that there are considerable difficulties with regard to its implementation in DoD. In particular:

- There is a lack of constant definitions and methodologies for the development of life cycle cost estimates
- The existing guidance in the form of A-76, A-121, FGAP-4, and various GAO reports does not provide a consistent framework for identifying life cycle costs
- DoD program managers find it extremely difficult to comply with conflicting, continuous demands for different cost information from DoD, Congress, OMB, GAO, etc.

- There is a definite lack of historical data to support realistic cost estimating
- There is often a lack of consistency over time within major programs regarding the basic structure, content and level of detail of cost estimates.

The net result of these problems is that major ADP programs encounter delays because of inconsistent estimates provided to oversight agencies without a sufficient cost audit trail. Further, the program management must often respond with redundant, crisis oriented efforts to develop life cycle costs for different requests.

In summary, there is a need for basic guidance within DoD regarding the application and implementation of Life Cycle Costing. This guidance should be responsive to the variety of different ADP programs covered within DoD Directive 7920.1. In particular, guidance for Life Cycle Costing must:

- Provide a consistent terminology and structure to allow program managers to respond to the various Life Cycle Costing requirements stipulated by A-76, A-121, Budgets, POM's, etc.
- Define estimation techniques appropriate for each of the life cycle phases.
- Specify alternative analytic techniques and procedures for use in analyzing cost information and in life cycle length determination.

Of particular importance is the need for a framework for life cycle cost estimating. This includes a basic cost structure for consistent definition of terms and uniform development of cost estimates. In particular, such a cost structure must clearly define the various life cycle phases or subphases, specific cost elements or object class categories, various functions for which costs are being incurred, and the organizational entities on which costs are either being imposed or attributed to (budget impact). Clearly, such a structure has to be flexible during the life cycle to allow for the expansion of cost detail required to support management decisions. Further, such a structure must support not only the development process of Life Cycle Management, but also provide cost information during the operational phase to assist configuration management, evaluate project performance, and collect the historical data necessary to assist in future cost estimation efforts.

Another example of major concern is the determination of the length of a project life cycle. Program life cycle cost estimates, and therefore management decisions, are heavily influenced by the length of time for which costs are accumulated. The choice of an appropriate life cycle length has been subjected to substantial discussion. Guidance is required regarding the selection of an appropriate life cycle length for different major ADP programs.

Strategy for the Future

There is clearly a need to resolve many of the basic problems with regard to Life Cycle Costing. In particular there is a need to:

- Work with the various concerned organizations such as GSA, OMB, and Congress to reconcile policy and directives regarding Life Cycle Costing
- Establish common terms and definitions in the context of these policies and directives
- Develop and utilize a historical cost data base for life cycle cost estimating
- Develop, communicate and disseminate supporting cost estimation models.

The development and implementation of a strategy to attack these basic concerns will take time. There is a substantial need for guidance to support current and planned programs in responding to existing directives.

As a result, in the near term, DoD has initiated an effort to provide assistance to the DoD components within the framework of current policy directives. This guidance will be in the form of a handbook, the DoD AIS Life Cycle Costing Handbook, which is intended to provide direct support to the program manager and program staff. The objective of such a handbook will be to provide:

- Guidelines to applicable directives and regulations regarding Life Cycle Costing, particularly emphasizing the various cost perspectives contained in these directives
- A recommended life cycle cost structure specifying various dimensions necessary to respond to the cost information requirements of the current directives and regulations
- Recommendations for the potential application of existing cost estimating tools and models, specifically identifying both the potential and the limitation of existing models
- The identification of the decision points within Life Cycle Management which should be supported by the application of LCC information.

The ultimate objective of these efforts is to improve the application of Life Cycle Costing at the program manager level and thereby to encourage the effective application of Life Cycle Management within DoD.

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